BBC MICRO USER

Volume 1 No. 1
March 1983 £1

The independent magazine that helps you to make the most of your micro

Win this BBC colour monitor in our exciting free contest!
– See Page 25

Play DEATH WATCH!

Iron out those cassette bugs

Build your own games paddle

What's good – and bad – in BBC software

Explore with the experts in programmers' workshop

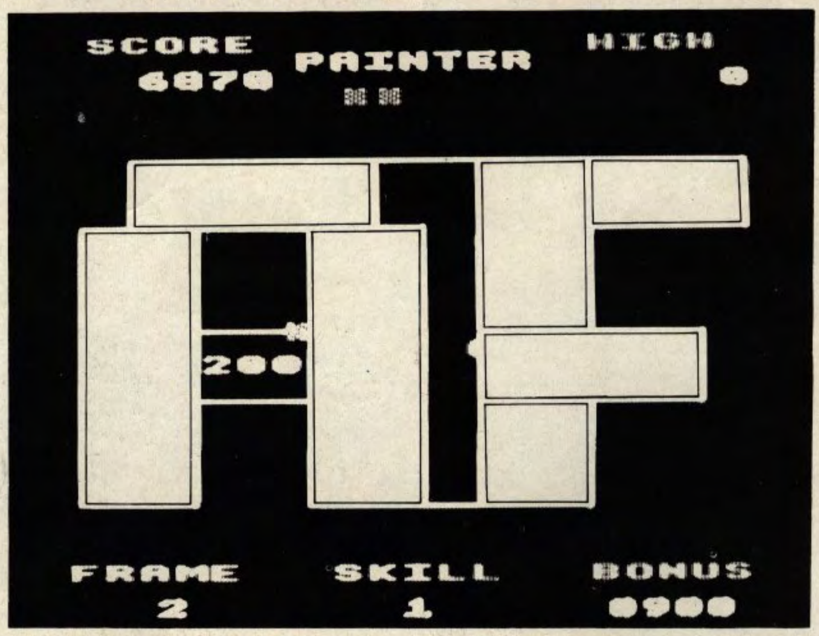
FREE! First of a series of handy time-saving crib cards to stick on your BBC Micro

SINCLAIR SIRIUS SPECTRUM BBC DRAGON ATOM SINCLAIR SIRIUS SPECTRUM

BBC DRAGON ATOM SINCLAIR SIRIUS SPECTRUM BBC DRAGON ATOM SINCLAIR SIRIUS SPECTRUM BBC DRAGON ATOM SINCLAIR

A + F SOFTWARE A + F

PAINTER £8-00

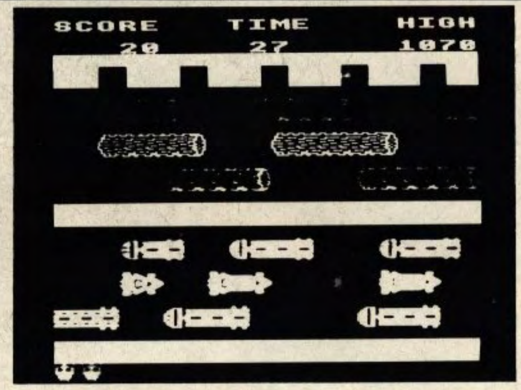


From the dark depths of "A&F Software's", development centre, comes the Game of the Year. 100% Machine Code, Fast, Addictive, Multiple Screens, High Score, Sound, Colour, 6 Skill Levels – "SOFTWARE AT ITS BEST"

Available now for all BBC users. Fill in the grids with your painter, before the chasing fizzers get you, drop gaps to confuse the fizzers, but don't trap yourself.
RUNS ON ALL OSI's requires 32k memory.

PRICES – **CASSETTE £8.00 – DISC £11.50**

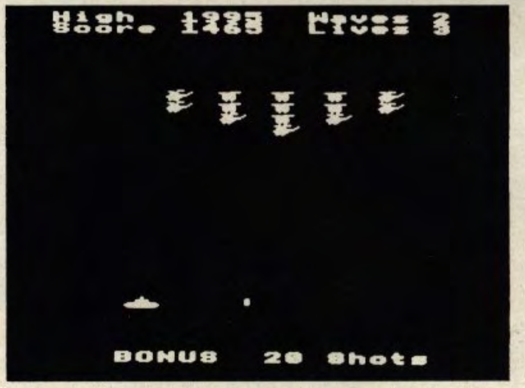
FROGGER



Arcade action with this version of the well known popular arcade game. Written in machine code to run on all OSI's in 32k. Can you get your Frog across the road and river to safety.

PRICES **CASSETTE £8.00 – DISC £11.50**

PLANES



Waves of aircraft and helicopters are attacking you, using your defence base you must destroy the diving raiders before they can wipe you out. Written in machine code to suit all OSI's will run on any 32k BBC.

PRICES **CASSETTEE £8.00 – DISC £11.50**

A fully interactive graphics adventure game, fight the monsters and demons as you find your way into the tomb room to steal the "Pharoah's Mask". Beware the "MUMMY".
Runs on all OSI's in 32k.

PRICES **CASSETTE £8.00 – DISC £11.50**

TORCH USERS – ALL PROGRAMS AVAILABLE ON DISC AT £15.50 PER TITLE

Orders to: **A&F SOFTWARE, 830 Hyde Road, Manchester, M18 7JD**
enclosing cheque/P.O. payable to A&F Software (MICRO-LINK).

061-223 6206
(24 hrs)

To avoid confusion please state BBC on your order thank you.
24 HOUR ANSWERING SERVICE FOR TELEPHONE ORDERS

Telex: 667461
(AHh A&F)

CLAIR SIRIUS SPECTRUM BBC DRAGON ATOM S

MICROVITEC
MICROVITEC
The monitor behind the BBC Micro

MICROVITEC
Cub
COLOUR DISPLAYS

Dealer enquiries to:

Microvitec Limited
Futures Way
Bolling Road
Bradford
BD4 7TU
England
Tel: (0274) 390011
Telex: 517717

Silicon Express Limited
Silicon House
Fowk Street
Rothley
Leicestershire
Tel: (0533) 374917
Telex: SILICON 34694

Available in three resolutions all capable of supporting mode zero – 80 column operation. From £249 + VAT. RRP.

Contact your local BBC Micro dealer for further details.

BBC MICRO USER
Play DEATH WATCH!
Iron out those cassette bugs
Build your own games paddle
What's good – and bad – in BBC software
Explore with the experts in programmers' workshop
FREE!

Vol. 1 No. 1 March 1983

Managing Editor
Derek Meakin

Features Editor
Mike Bibby

Art Editor
Peter Glover

Advertisement Manager
John Riding

Advertising Sales
John Snowden
Mike Hayes

Tel: 061-456 8383 (Editorial)
061-456 8500 (Advertising)
Telex: 667664 SHARET G

Published by:
Database Publications Ltd,
Europa House, 68 Chester Road,
Hazel Grove, Stockport SK7 5NY.

Subscription rates for
12 issues, post free:
£12 – UK
£13 – Eire
£18 – Europe
£15 – USA (surface)
£25 – USA (airmail)
£15 – Rest of world (surface)
£30 – Rest of world (airmail)

BBC Micro User welcomes program listings and articles for publication. Material should be typed or computer-printed, and preferably double-spaced. Program listings should be accompanied by cassette tape or disc. Please enclose a stamped, self-addressed envelope, otherwise the return of material cannot be guaranteed. Contributions accepted for publication will be on an all-rights basis.

© 1983 Database Publications Ltd. No material may be reproduced in whole or in part without written permission. While every care is taken, the publishers cannot be held legally responsible for any errors in articles or listings.

BBC Micro User is an independent publication and neither the BBC nor Acorn Computers Ltd are responsible for any of the articles in this issue or for any of the opinions expressed.

Distribution to the news trade in the UK and Ireland is by Wells Gardner, Darton and Co Ltd., Faygate, Horsham, West Sussex RH12 4SU (tel: Faygate 444). Enquiries regarding overseas distribution should be made direct to the publishers.

CONTENTS

9 **NEWS**
Keep up to date with all the latest developments in the bustling BBC Micro world.

14 **TUTORIAL**
We show the first-time user that programming is nothing like as hard as it might sound.

19 **TAPE OFFER**
Save yourself the chore of keying in programs from this issue with our cassette.

20 **DO-IT-YOURSELF**
A step-by-step guide to building a cheap but highly efficient BBC Micro games paddle.

24 **WORD PROCESSING**
We put the Alphabeta WP package through its paces – and find it useful but over-priced.

25 **COMPETITION**
Find a way of completing our unfinished program – and win a BBC colour monitor.

26 **COLOUR**
Have fun in the wonderful world of computer colour with our explicit beginner's guide.

32 **HOW IT WORKS**
Conducted tour round the inside of the BBC Micro starts with the operating system.

38 **TAPE TROUBLES**
Do you have problems loading programs on cassette? We may have the answers.

40 **GAME of the MONTH**
We start off with a bang. There's only one word for "Deathwatch" – stupendous!

43 **BOOKSHELF**
Our team of critics review 11 books that will help teach you more about the BBC Micro.

46 **INTERVIEW**
A regional head of MEP talks about the micro explosion now under way in Britain's schools.

49 **SOFTWARE**
Programs galore – but are they all they claim to be? Our frank reviewers give you the facts.

50 **UPGRADE**
Turn your "A" into a "B" for half the price in our helpful Beeb Body-building Course.

55 **GRAPHICS**
Our "Shapes" program helps you create your own computerised portrait gallery on tape.

60 **NUMBERS**
How to use random numbers to write easy games – and have fun with Bingo too.

63 **MONITORS**
Thinking of buying a colour monitor? You ought to read this article before you do.

64 **BUBBLESORTS**
Sorting routines that speed up processing time, with listing for a fast Double Bubble.

67 **WORKSHOP**
A forum for your ideas, starting with a test for function keys in machine code routines.

71 **SAVE MONEY!**
A subscription ensures you get BBC Micro User every month – and there's a £2 saving.

Editorial

Exploring the full potential

WELCOME to the first issue of BBC Micro User – the new totally independent magazine written for and by enthusiastic users of the BBC Micro.

Our aim is to provide a thoroughly professional magazine devoted exclusively to developing every aspect of the amazing potential of this exciting microcomputer system.

Whether a complete novice or an experienced programmer, you'll find lots of interest among the many articles written by our expert contributors.

And, since we believe that users of the BBC Micro wish to do more with their machine than unthinkingly type in listings, you will also find that our coverage of the whole spectrum of BBC Micro applications — vast as it is – will be complete and well explained.

To do this we need your help. We need your contributions, ideas, criticisms and shared enthusiasm. So write to us, please. Our address is:

BBC Micro User,
Europa House,
68 Chester Road,
Hazel Grove,
Stockport,
SK7 5NY

The contents of the magazine will reflect YOUR interests, so be sure to let us know what you would like to see in these pages.

Already on our drawing board are plans for a disassembler, a contour drawing program, a series on machine code that is really aimed at the beginner, several exciting games and a host of other features that will help you make the most of your micro.

Finally, one thing we are not going to do is to waste space on long editorials – we've got better uses for it!

So thanks for reading, and, if I don't hear from you in the meantime, see you next month.

Mike Bibby

GEMIN

PERFORMAN

It can do a powerful job for y

SPECIAL LIMITED OFFER

Buy just any two programs at £19.95 and take one at £19.95

FREE!

CASH BOOKS ACCOUNTS PROGRAM FOR BBC MICRO . . .£95.00

New

One of the most innovative business programs on the market. Most serious accountancy packages are written and coded by professional and competent programmers. The Gemini Cashbook Accounting program was written by practising Chartered Accountants and coded by professional and competent programmers. This is a fundamental difference.

This practical program is simple to use and will replace your manual cash and bank records and by giving you instant management information, it may even put your accountant out of job!

With exceptionally exhaustive user documentation, full technical back up and product update policy this program will increase the efficiency and profitability of your business. Take a look at the information this program will provide.

* summary of VAT information to enable you to complete your VAT returns
* cumulative receipts and payments report analysed over the standard profit and loss and balance sheet heading.
* option for departmental analysis of sales and purchases
* print out of all transactions
* journal routine for entering transfers between accounts and year end adjustment for debtors, creditors etc.
* year end trial balance
* profit and loss account and balance sheet.

These statements can be produced at what ever interval you require e.g. monthly, quarterly or annually.

Coming soon:– Integrated Sales + Purchase Ledgers

> ". . . the systems worked immaculately when tested . . ."
> "Mailist is a very professional piece of software . . ."
> (Which Micro & Software Review Feb 83)

Here's a range of software for the independent businessman that's designed to harness the power of your micro to deliver the vital information you need in all key areas of your business. A breakthrough on both price and performance, each program is fully tested and comes with all the documentation back up you need.

> "Gemini's range of software is in the vanguard of the releases for 'serious' micro users . . ."
> (Which Micro and Software Review)

SPREADSHEET ANALYSIS
BEEBCALC £19.95
DRAGONCALC £19.95

New

FOR BBC AND DRAGON 32. Spreadsheet processors have proved to be important tools for using micros in business, scientific and domestic financial applications.

Without any programming knowledge at all, you may:–
* Set up a computerised spreadsheet, with chosen row and column names.
* Specify formulae relating any row or column to any other.
* Enter your source data and have the results calculated.
* Save the results on tape (or disk – BBC) for later reloading and manipulation.
* Print the tabulated results in an elegant report format.
* Experienced users may access saved files and write their own reporting or graphics presentation programs for the results.

Some typical applications:–
* Small business accounting applications, e.g. profit and loss statements and cashflow projections, break-even analyses etc.
* Investment project appraisal – anything from double glazing to oil rigs!
* Comparing rent/lease/buy options
* Processing the results of scientific experiments or field studies
* Engineering calculation models
* In fact, anything that involves repeated re-calculation of results presented in tabular or spreadsheet format.

Program Availability Chart:–

	Database	Stock Control	Mailist	Invoices & Statements	Spread sheet Analysis	Cashbook Accounting	Word processor	Home Accounts	Commercial Accounts
Sinclair Spectrum 16k or 48k	●	●	●					●	●
Dragon 32k or 64k	●				●			●	
VIC20 (16k+)	●	●	●	●				●	●
Sinclair ZX81 (16k+)	●								
Grundy Newbrain	●								
Texas T199 4A	●								
Osborne 1	●								
Sharp MZ80A	●	●	●	●				●	●
Sharp MZ80K	●	●	●	●				●	●
Sharp MZ80B	●	●	●	●				●	●
BBC micro model A or B 32K	●	●	●	●	●	●	●	●	●

I'S NEW
CE SOFTWARE
ur business at petty cash prices.

INVOICES AND STATEMENTS . . . £19.95
Compatible with most micros. See table. Ideal for the small business. A complete suite of programs together with generated customer file for producing crisp and efficient business invoices and monthly statements on your line printer. All calculations include VAT automatically, and the program allows your own messages on the form produced. This program gives you superb presentation and saves time on one of the most tedious tasks in the office.

COMMERCIAL ACCOUNTS . . . £19.95
Compatible with most micros. See table. A gem of a program, all for cassette, with the following features:– Daily Journal. Credit Sales. Cash Sales. Credit Purchases. Purchases – other. Sales Ledger. Purchase Ledger. Bank Account. Year to date summary. A fully interactive program suitable for all businesses. Files can be saved and loaded and totals from one file carried forward to another on cassette. Particularly useful from a cash flow point of view, with an immediate accessibility to totals for debtors and creditors. Bank totally supported with entries for cheque numbers, credits and, of course, running balance.

MAILING LIST . . . £19.95
Compatible with most micros. See table. A superb dedicated database to allow for manipulations of names and addresses and other data. Gemini's unique 'searchkey' system gives you a further ten 'user-defined parameters' to make your own selections. Features include the facility to find a name or detail when only part of the detail is known, it will print labels in a variety of user specified formats.

DATABASE . . . £19.95
Compatible with most micros. See table. The program that everyone needs, the most valuable and versatile in your collection. Facilities include sort search, list print if required. Can be used in place of any card index application; once purchased you can write your own dedicated database to suit your particular needs with a limitless number of entries on separate cassettes.

STOCK CONTROL . . . £19.95
Compatible with most micros. See table. Dedicated software with all that's necessary to keep control of stock. This program will take the tedium out of stock control and save time and money. Routines include stock set up, user reference number, minimum stock level, financial summary, line print records, quick stock summary, add stock, delete/change record and more.

HOME ACCOUNTS . . . £19.95
Compatible with most micros. See table. Runs a complete home finance package for you with every facility necessary for keeping a track of regular and other expenses, bank account mortgage, H.P. etc. This program also allows you to plot graphically by Listograms your monthly outgoings.

WORD PROCESSOR . . . £19.95
Compatible with most micros. See table. This program features routines found in much larger and more expensive packages with a typical word length of 5-6 letters it allows for around 1000 words in memory at one time. Ideal for the user who requires a simple program to write letters on his computer. Features include, block delete, block insert, search and replace, edit text, display text and more.

Dealer/Trade enquiries invited – generous trade discounts for quantity
Special ACCESS card instant sales hotline
for GUARANTEED despatch within 24 hours . . . **Tel: 03952-5165**
24 hr Ansaphone Service.
All enquiries other than credit card sales to 03952-5832
Gemini. Functional Software Specialists. 9, Salterton Road, Exmouth, Devon.

Tick the box for Program you require. Prices include V.A.T. and Package and Postage.
Please supply the following cassette software.

Database	£19.95	☐	ZX81 16K Database	£9.95	☐
Stock Control	£19.95	☐	BBC Cash Book disk or tape	£95.00	☐
Mailing List	£19.95	☐	BBC Disks – other titles	£23.95	☐
Invoices and Statements	£19.95	☐	Osborne Disk Database	£23.95	☐
Commercial Accounts	£19.95	☐	Word processor	£19.95	☐
Home Accounts	£19.95	☐	Beebcalc	£19.95	☐
			Dragoncalc	£19.95	☐

Name____________________

Address____________________

Machine Type__________ Memory Size__________

I enclose____________________

Make cheques and postal orders payable to Gemini Marketing Ltd.

Diners Card Number__________ Access Number__________

DINERS CLUB INTERNATIONAL BARCLAYCARD VISA Signature__________

Gemini. Functional Software Specialists, 9 Salterton Road, Exmouth, Devon.

GEMINI MARKETING
LIMITED

Whatever the system–insist on Kaga monitors

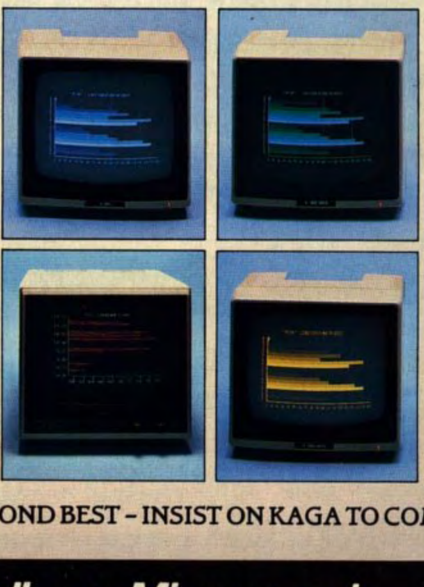
KAGA
RGB
POWER

First choice for quality: Kaga Monitors enjoy a world-wide reputation for superb definition and clarity of image whether in Green, Amber, Black and White or full RGB colour.

First choice for value: Kaga quality at Kaga prices makes Kaga unbeatable.

First choice for reliability: Kaga Monitors are specifically designed for use with computers, custom-built for the functions they perform, with solid state circuitry to ensure utmost reliability.

First choice for compatibility: Kaga Monitors are compatible with all popular micro computers. Apple™, Acorn/BBC™, Commodore Pet™, IBM™, Osborne™, Tandy™, you name it, Kaga's made for it. Kaga RGB Monitors have built-in switchable interface allowing simple plug-in compatibility for most micros with RGB output. And the wide range of Kaga models means there's a Kaga ideally suited to your individual needs, whatever your computer.



First choice for availability: Wherever you are, there's a Data Efficiency Kaga dealer close at hand to advise and help you before and after you choose your Kaga Monitor. Ring 0442 60155 for details of your nearest stockist.

Kaga Models and Prices:
RGB Monitors from around £264 (retail)
Monochrome Monitors from around £99 (retail)
Apple II RGB Adaptor and RGB Cables for most popular micros are available.

Prices ex-VAT and correct at time of going to press

Trade and OEM enquiries welcome

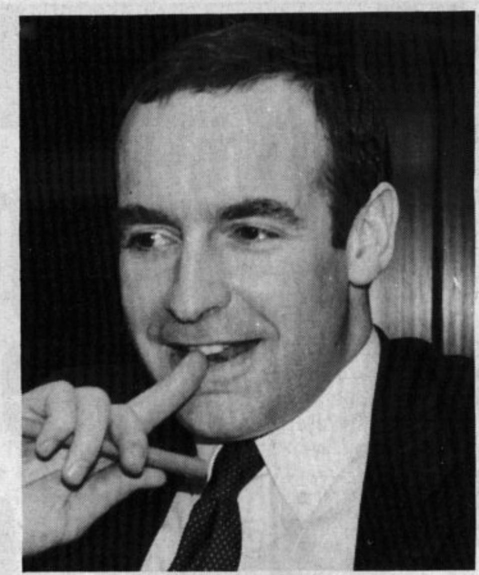
DON'T SETTLE FOR SECOND BEST – INSIST ON KAGA TO COMPLETE YOUR SYSTEM

DE
Data Efficiency Ltd

For all your Micro needs...and more. (0442) 60155

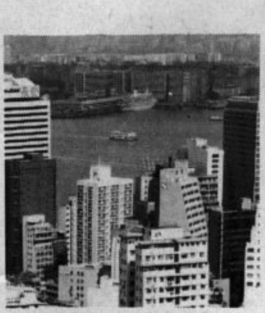
Sole UK Distributors, DATA EFFICIENCY LIMITED, Computer Peripherals Division, Finway Road, HEMEL HEMPSTEAD, Herts. HP2 7PS Tel: (0442) 60155 (14 lines) Telex: 825554 DATEFF G

BBC MICRO USER
March 1983
NEWS



Chris Curry ... high hopes of big European sales

Now production hits 11,000 a month



Hong Kong's pilot plant is now in production

PRODUCTION of the BBC Micro has now reached 11,000 a month at the three British plants used by Acorn, and this figure is expected to be stepped up considerably when the company starts opening up the European market.

"We have hopes of considerable sales throughout Europe", Acorn joint managing director Chris Curry told *BBC Micro News*.

"But these are early days, and we have a long way to go yet.

"We have just opened a branch office in Munich, and we look on Germany alone as a very big market indeed. We are convinced the BBC Micro will do very well there."

The European market will be supplied with machines built in the UK. Orders from the rest of the world will go to Hong Kong, where Acorn have recently set up a production line.

Said Curry: "It is very much a pilot plant at the moment, and is turning out 2,000 machines a month. But when it is on full capacity it will be producing 10,000 a month.

"Initially the Hong Kong operation will be supplying the Far Eastern and Australasian markets.

"The main demand so far is coming from Australia, where Acorn have been active since 1979 when they started shipping out the Atom."

The BBC Micro was introduced there six months ago, but supplies were extremely restricted at first because Acorn were under an obligation to the BBC not to start opening export markets until they had first cleared up the backlog of orders in the UK.

Now the situation at home has been eased, an increasing number of machines are reaching Australia, and have been very well received.

HI-SCI UNIT

PRODUCTION is about to start of Acorn's IEEE expansion unit – which will make the micro probably the most versatile and cost-effective computer for scientific and technical applications available.

Retailing at around £200, it is a full implementation of IEEE standards.

Upgrade costs £10

CURRENT deliveries of the BBC Micro are fitted with OS 1.2 as standard. Acorn report they are waiting until they have sufficient stocks of the ROM before supplying users with replacements for users with OS 0.1.

The upgrade, they confirm, will be fitted for £10. This includes giving the machine a check-up.

Acorn point out there will be no more versions of the OS 1 series. In fact they refer to OS 1.0 and OS 1.2 jointly as "Operating System One", and consider them equally effective.

They also scotch rumours of a new Basic II ROM being issued.

MAJOR SALES DRIVE IN THE USA

ACORN are planning an aggressive drive into the educational market in the USA, cashing in on the tremendous amount of interest expected to be generated by the screening of the BBC's computer series on American television.

While Acorn's marketing strategy is still being worked out, they are confident they will be able to start with shipping at least 5,000 BBC Micros a month to the USA.

They say they see no reason why sales in the United States should not even overtake those in the UK.

They are pinning their faith on the publicity that will undoubtedly be generated when the Public Broadcasting System starts showing last year's introductory series, "The Computer Programme".

This will be networked in every major city in the USA – a tremendous coup for BBC Enterprises' sales team.

Acorn plan to use the launch of the series on April 16 to preview the BBC Micro to American computer dealers.

They have already had preliminary talks with one of the country's biggest dealership chains, Computerland.

Say Acorn: "Our main competitors in the educational field in the States are Apple and Radio Shack, which are both very firmly entrenched.

"But they cannot compete with the BBC Micro in terms of price or performance – nor do they have the benefit of the BBC machine's networking capabilities, nor the support of a major TV series."

Transmissions of "The Computer Programme" end on June 18, but TV chiefs in the USA who have already seen the first programmes in the current run of the follow-up series, "Making the Most of the Micro", have already expressed strong interest in taking this as well.

Nationwide transmission could well start in the autumn.

Most schools are opting for the BBC machine

MORE than 4,000 primary schools have applied for grants under the government's scheme that allows them to buy micro packages at half price.

Latest figures show that a massive 87 per cent have opted for the BBC Micro instead of the two other approved machines, the much cheaper Spectrum and the much dearer 480Z.

This means that many thousands of children in primary schools will be starting their computer education using the BBC Micro.

The package consists of a Model B, cassette recorder and either a 12in black and white monitor or the 14in Microvitec colour monitor.

Depending on the choice of monitor, all the school has to pay is either £270 or £325.

Faced with this choice it is perhaps not surprising that 99 per cent of schools prefer the colour package.

The scheme was announced last September, but a big rush of applications is now coming in as the end of the financial year approaches.

Said a spokesman at the Department of Industry, who sponsor the scheme: "We are processing applications as fast as we can, but it is taking at least three months to get them approved."

It was hoped that all of Britain's 27,000 primary schools would have their own computer by the end of 1984, when the scheme finishes.

But interest is so great the target is expected to be reached long before then.

So MUSE is not amused

LAST month should have seen publication of the long-awaited MUSE report on the educational potential of the BBC Micro.

But the teachers running MUSE – Microcomputer Users in Education – have had to admit defeat.

They have had a review team standing by to write the report since last June, and publication was planned for September.

But because of "the much publicised production difficulties of the micro itself" they found they were unable to get their hands on the machine, and decided to shelve the issuing of the report until February.

What's the hold-up now? "Much the same story", said a MUSE spokesman.

"Acorn have been unable to supply the review equipment we need."

However, teachers still desperate to know whether the BBC Micro has any educational potential need wait no longer.

All they have to do is read BBC Micro User – and make up their own minds.

Expander gives colours galore

USERS with colour monitors will soon be able to produce anything from lighter shades of pale to Joseph's Technicolour Dreamcoat.

That's the claim of Clywd Technics, who have developed a colour expansion unit which produces a remarkable variation over standard hues.

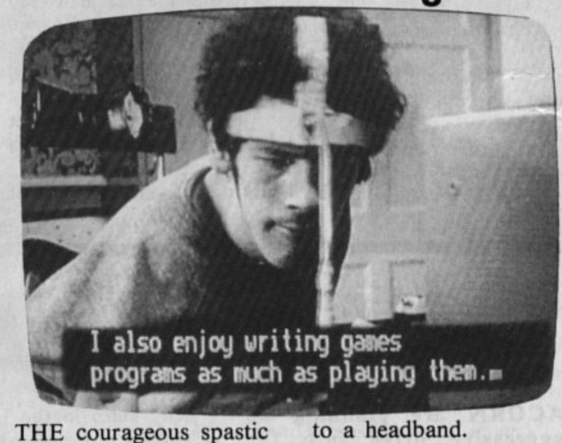
The idea came from Wrexham Art College, which is investigating new applications for computer-aided design in the production of fabrics and textiles.

"The unit will produce any seven colours on the screen out of a possible 4,000," said Ian Winter, Technics' general manager.

Initially the company is turning out up to 25 units a week.

Said Ian: "We are very keen to observe reactions because it has a diverse range of applications and potential – plus a price which won't make users see red."

Reviewer courageous



I also enjoy writing games
programs as much as playing them.

THE courageous spastic whose remarkable story introduced the current BBC TV series "Making the Most of the Micro", has joined *BBC Micro User's* team of software reviewers.

Richard Gomm, now studying for a PhD at Swansea University, cannot speak, walk or control his limbs. But he has taught himself to use a micro by tapping the keys with a stick attached to a headband.

And he has become so proficient that he is now writing software to help other disabled people use micros to extend their activities.

At the suggestion of *BBC Micro User* Acorn have given Richard a BBC Micro – and he will be using a word processing program he wrote himself to tell our readers what he thinks of latest software releases.

Now it costs so little to save a life

THAT computerised sick bay in the Starship Enterprise gets a step nearer.

This BBC Micro is in the intensive care unit of St Thomas's Hospital in London, and has proved such a time and money saver that another dozen are now on order.

It is used to keep a vital check on a heart patient's progress by calculating how many litres of blood are being pumped round the body every minute.

Consultant Ron Bradley says it would cost about £90,000 to equip the whole unit using another computer, which would certainly not be sanctioned in the present state of Health Service finances.

But with the BBC Micro it could be done for under £10,000 – well within the scope of most hospitals.

He forecasts that when word gets around many more hospitals will be following St Thomas's lead.

WHEN the BBC launched The Computer Programme last year the National Extension College decided to cash in on the publicity and produced their "30 Hour Basic" self-tuition course.

Modestly they printed 5,000 copies, but such was the demand they ended up selling more than 100,000.

This year they're not taking any chances. They are providing not one but five courses – selling at £50 a time.

After Visicalc . . here comes Beebcalc

BEFORE long firms should be able to run all their company's accounts on the BBC Micro.

That's the view of Dale Hubbard, managing director of Devon software house Gemini.

And he is producing a whole series of programs that will help make his dream a reality. Two are released this month.

One is Beebcalc – a BBC version of the world's top-selling business program, Visicalc. It costs £19.95.

The other is his top-of-the-range Cash Books Accounts program, a complete accountancy package which sells for £95.

Said Mr Hubbard – who has two chartered accountants on his board of directors: "Similar programs on the Apple and Superbrain would cost up to £1,500.

"We decided to develop business software for the BBC Micro because we felt it was the machine with the greatest potential.

"We took into account its speed of operation and the fact that it was designed as an expanding system.

"We felt that we could offer businessmen value for money with a machine that wouldn't be dated.

"We have been so impressed that we have decided to stick very firmly with the BBC Micro.

Modular

"We are now writing more business software. Next will come tax programs, integrated sales and purchase ledger, stock control and so on. We shall end up with a completely modular series of programs that will run an entire business."

Fellow director David Perkins said: "We originally intended writing business software for the Apple. But after looking at a variety of programs we decided that they were far from user friendly, and had been written by programmers, not accountants.

"So we looked at the BBC Micro and found that its Basic was very powerful indeed – just what we needed for our programs.

"What we have produced is really an idiot's guide to doing your own books. Yet it is a very sophisticated program, and once you have entered your figures it handles them just as would an accountant. For instance, management reports can be produced at any interval you require."

● *Future issues of BBC Micro User will include a step-by-step guide to business accounting on the BBC Micro.*

BBC's MAN IN THE MICRO

IAN McNaught-Davis, presenter of the BBC's "Make the Most of the Micro", says he cannot accept complaints that the series is too condescending in its approach.

"It's unique", he told *BBC Micro User*.

"And it is creating considerable interest from both novices and more experienced users.

"One of the difficulties when presenting such a series is to ensure everyone fully understands the terminology.

"But I believe the right formula has been reached, making the series as intelligible as possible with the selective use of technical jargon".

A larger-than-life Ian McNaught-Davies, as he was seen superimposed on the motherboard of the BBC Micro at the start of the current TV series

Development's the name of the game..

Hermann Hauser ... "tremendous effort."

NEARLY half the staff at Acorn Computers – 70 out of a total workforce of 150 – are now engaged in design and development.

The dramatic increase in the number of people engaged in research emphasises the company's commitment to the introduction of new computers to follow on their success with the BBC Micro.

Determined

Said joint managing director Hermann Hauser: "We are putting a tremendous amount of effort into this aspect of the company's activities. We are determined to extend our lead over the competition".

First major product to come off the Acorn drawing board will be the long-heralded Electron, a cut-down version of the BBC Micro, using BBC Basic but with a different operating system and a price tag somewhere between the 16k Spectrum (£125) and the 48k version (£175).

The Electron is expected to be launched next month.

Next will come the much more powerful Acorn business machine. This will be aimed particularly at the small business market, at present dominated by machines like the Apple and Sirius, which are now meeting aggressive competition from the recently-launched IBM Personal Computer.

But there is still a lot of work to do on the Acorn machine – which at the moment is simply code named ABM – and it is unlikely to be ready for release until the autumn at the earliest.

Policy

Also under wraps are plans for what is tentatively called the Acorn work station.

While Acorn has a strict closed-lips policy about future plans Hauser said: "We are looking ahead at the next generation of computers, and we have certainly got our eyes on the top end of the personal computer market."

Advanced graphics for the B

DESIGN engineers whose normal task is to service the oil industry all over the world have created an advanced graphics package for the BBC Model B.

Salamander Software, who market it, say it has a wide number of uses in the home, business and education.

The system, priced at £24.95, is controlled entirely by normal keyboard output.

It uses cassette tape for software and picture storage, and requires no additional hardware.

Salamander say future expansion plans include a full disc based version with extensive CAD type facilities.

Inputs from analogue paddles and graphics tablets will also be catered for, as will hard copy printout of drawings.

More power on its way

APRIL will see the launch of the 8 bit 6502 and Z80 second processors, both of which will add 64k RAM to the memory of the BBC Micro.

Price is expected to be in the region of £200.

An even more powerful 16 bit processor, which will add another 128k, should appear in the late summer, with a price tag of around £700.

In the meantime Torch Computers report growing sales for their BBC Micro disc drive, which is used in conjunction with a Z80 board.

Fitted inside the BBC Micro, it provides 64k of memory and allows the running of CP/N programs.

CP/N is the ROM-based version of CP/M, a standard operating system that gives users access to literally thousands of readily-available programs, mainly in the field of business.

The Torch drive is being bought in large quantities by educational users.

At least one more second processor board is being launched in the near future, reportedly with better specifications than either the Acorn or Torch board.

For more details, watch this space.

BARRY WOOD'S TAILPIECE

WHAT is it about Cambridge that's caused the proliferation of computer firms there? Is it the rarified intellectual atmosphere . . . or perhaps its lack of contact with the real world?

Take disc interfaces, for instance. Ask Acorn and you'll be told that the country is flooded with them. Ask the dealers, and you'll get a hollow laugh.

So where are all the interfaces? Still in Cambridge? Or is that just an academic question?

★ ★ ★

ONE thing I've learnt from being involved in computing is the reason why our education system is in such a parlous state.

It is not that we intend it to be so, but just that we don't know the meaning of the word education.

I realised this after a couple of hours looking at some so-called "educational" software. Any nation that produces such utter rubbish and then labels it educational, just doesn't know what the word means.

★ ★ ★

ARE the days of the BBC Model A numbered? Latest reports from dealers are that almost every new user is buying the Model B.

It is widely believed that when the cheaper Electron is launched by Acorn in the spring, the Model A will quietly be allowed to disappear.

BBC I.J.K.'s RANGE OF QUALITY SOFTWARE CONTINUES TO EXPAND... BBC

BBC Micro Games

MODEL A/B

Cassette 1: Star Trek/Candy Floss (very popular) **£6.50**
Cassette 2: Family Games (hours of fun) **£4.50**
Cassette 3: Mutant Invaders/Breakout **£6.50**
Cassette 8: Model A Invaders (M/C) **£5.50**

MODEL B (or A+32K)

Cassette 4: Beeb-Beep (Super Simon Game) **£4.50**
Cassette 5: Beebmunch (full colour Munchman) **£6.50**
Cassette 6: Super Hangman (animated, educational) **£4.50**
Cassette 7: 3D Maze (fast and intricate) **£4.50**

CASSETTE 9

Contains model B Invaders. A superb feature adaptation of the arcade 'Space Invaders' game in machine code and hi-resolution colour graphics for the BBC Micro model B (or A+32K). Play normal game or choose from the many options including Missile, Bomb and Invader speeds. Invisible Visible and Shields no Shields. Quite simply the best.

Only £7.50 for MODEL B (or A+32K)

CASSETTE 10

WORDPRO. Cassette based word processor for either Epson or Seikosha printers. Features right hand justification, alter, insert, delete, pages to tape, printer mode changes from within text line etc., etc. Complete with manual.

Only £10.50 inc. for MODEL B (or A+32K)

CASSETTE 11

ATLANTIS. The superb fast action arcade game written in machine code to illustrate to the full the machines fantastic colour graphics and capabilities. This game includes all the usual ATLANTIS/SCRAMBLE features. Guide your submarine Nautilus along the undersea landscape and through the caverns avoiding mines, depth charges, rockets, jelly fish, serpants etc.

Only £7.50 inc. For MODEL B (or A+32K)

CASSETTE 12

FLAGS. A superb educational program. The flags of the world are drawn in hi-resolution colour graphics. The program then tests your knowledge of flags and geography. Have fun while learning.

Only £4.50 inc. For MODEL B (or A+32K)

CASSETTE 13 – HYPERDRIVE

A new, very addictive machine code arcade game. Guide your laser tanks around the network of passages destroying the drone Aliens – but beware, evil OTTO lies in wait!

Only £6.50 inc. For MODEL B (or A+32K)

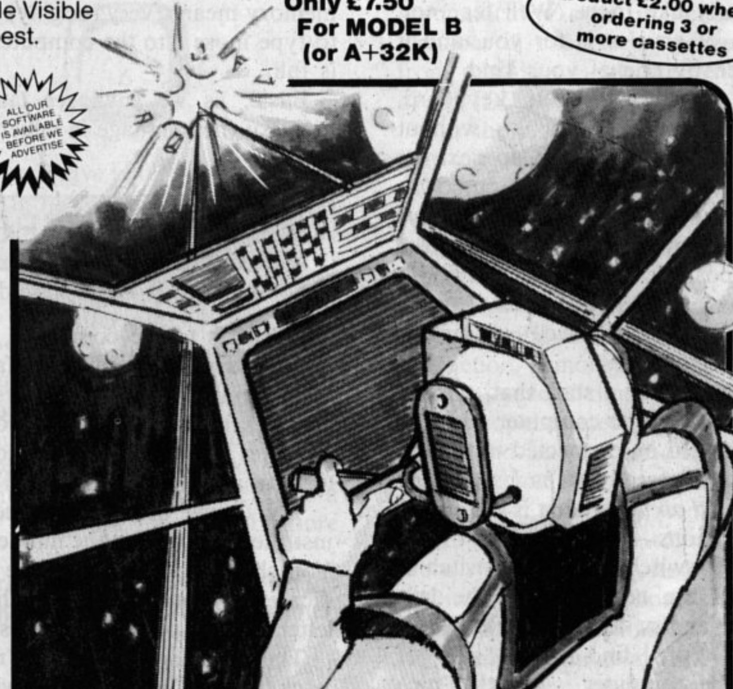
CASSETTE 14 – STRATOBOMBER

Another new highly colourful machine code arcade game. Can you keep the enemy fleet at bay long enought to destroy the nuclear reactor of the rogue Star Ship before it destroys your home planet? Superb graphics.

Only £7.50 For MODEL B (or A+32K)

Deduct £2.00 when ordering 3 or more cassettes

ALL OUR SOFTWARE IS AVAILABLE BEFORE WE ADVERTISE



WE'RE EXPANDING TOO... NOTE OUR NEW OFFICE ADDRESS AND CUSTOMER SERVICES

ALL PRICES FULLY INCLUSIVE OF VAT AND P&P – NO MORE TO PAY!

- All Programs will run on all operating systems
- All software in stock before we advertise
- Send SAE for Brochure

IJK Software Limited

9 King Street,
Blackpool, Lancashire
(0253) 21555/856875

24 HOUR ANSAFONE

48 hour despatch

OFFICES OPEN

10am – 5pm Tues-Sat

BARCLAYCARD VISA

BBC MICRO GAMES

If you don't know your output port from your interface, this is for you . .

Programming is easier than you think

By MIKE BIBBY

I don't know who you are. You might be a wife whose BBC Micro-owning husband is away at work, or a father who is trying to come to terms with his son's Christmas present.

Alternatively you might be a teacher who has just been "computerised". Whoever you are, the fact that you are reading this article tells me your guilty secret: You want to be able to programme the BBC Micro.

But how to begin? You must have noticed that some people take to computing like ducks to water, or an output port to an interface, as they would say.

Words like byte, strings and user-defined functions flow freely from their lips. They pass global parameters and handle interrupts with ease, then get their hands on the peek and poke in a way that beggars belief!

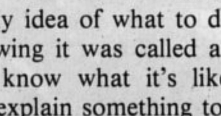
You, I take it, are not like that. You are not a computer "natural". But you would dearly like to be. Well fear not, this series of articles is for you, and it was written by one of your kind.

I, too, have sat at a keyboard, watching the cursor blink, without having any idea of what to do next (or even knowing it was called a cursor).

I also know what it's like to have someone explain something to me in the "simplest possible terms" and still find it way above my head. Yet I now programme reasonably well . . . and so can you. Read on!

Let's assume for a start that you are seated in front of the computer which is already plugged in, connected to the TV and tuned in correctly. *(The User Guide is pretty good on this.)* That is the end of our assumptions.

The "On" switch is a rocker switch at the rear of the computer on the left. Reach over and switch on (and the TV if necessary). You'll find the first sign of life from the computer is a rather nice beep. Then you'll notice a message on the display something like this:



```
BBC Computer 32K
BASIC
>_
```

The exact message varies depending on your machine. For instance, if you have a model A, it will say 16k instead of 32k. This is because a model A has only half the memory of a model B – "k" being a measure of memory and 16 being half of 32!

In computing terms, having more memory means (very roughly) being able to type more into the computer before it is full.

Basic, as we shall see later, is the name of the language in which you give instructions to the computer.

The > symbol which, you may remember from your schooldays, means "greater than", is called the prompt. This indicates that the micro is ready for you to type in some information.

Try typing in two or three letters – just the alphabet for the moment, please. You should soon see that the cursor indicates the position at which the next letter will be printed on the screen.

The letters appear in white on a black background. We say that white is the foreground colour and black the background colour.

Later we shall see how to alter these colours, but for the moment, before we type any more, let's examine the keyboard.

Fundamentally, it is a standard typewriter keyboard surrounded by several additional keys. Notice that the computer has a 0 (zero) key and another key for the letter O. On the BBC Micro you must keep the two separate: 0 for numbers, O for words.

I guarantee that a lot of your early errors in programs will be caused by typing O instead of 0!

On the same lines, notice that there is a 1 (one) key. Make sure you do not use "l". (Incidentally, a lot of your other early errors in your computing career will be from misreading l as 1 and vice-versa.)

Other keys are labelled by words such as SHIFT, ESCAPE and RETURN. Let's introduce a convention to make life easier: If I want you to press the key labelled RETURN, for instance, I will ask you to type

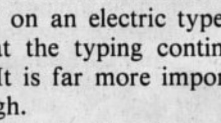
[Return]

If I ask you to type the word RETURN you have to type R, then E, then T and so on. The symbols [] enclosing a word indicate that you are to press one key with that word on it. You do not spell it out.

Now RETURN is quite an important key. We use it in a similar manner to the return key on an electric typewriter, to ensure that the typing continues on a new line. It is far more important than that, though.

RETURN not only gives you a new line but also sends the message typed into the computer to be acted upon.

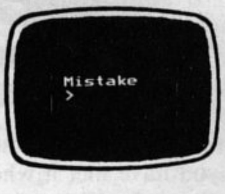
If you have been following so far, you should have typed a few letters on your screen so that it looks something like:



```
BBC Computer 32K
BASIC
>TTLKR_
```

If not, type a few letters now. Next,

press [Return]. Odds on, you'll get a message back from the computer saying:



```
Mistake
>
```

Don't worry about the Mistake message. You can't hurt the computer by accidentally mistyping something, so feel free to experiment.

All that Mistake means is that the computer doesn't understand the words you've just sent it. You see, it needs to be spoken to in its own language, which is called Basic.

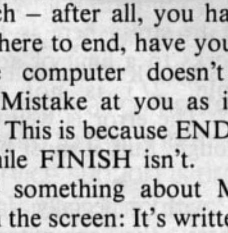
However, learning Basic isn't like learning a genuinely foreign language; Basic is very similar to English but it only allows selected English words to make things simpler for the computer.

This, by the way, is the reason I said that it was odds on you would get Mistake returned from the computer. You might, by chance, have hit on a Basic word.

For example, in Basic you can mark the end of a program with END. The people who designed Basic could have chosen the word FINISH to do this.

Type END and press [Return]. Then try FINISH and press [Return].

Note the difference:



```
>END
>FINISH

Mistake
>_
```

Admittedly, END doesn't accomplish very much – after all, you haven't anything in there to end, have you? – but at least the computer doesn't hurl the message Mistake at you as it did with FINISH. This is because END is a Basic word, while FINISH isn't.

Notice something about Mistake as shown on the screen: It's written in lower case, i.e. small letters. So far, your typing should have been appearing in upper case, i.e. capitals, only. Let's investigate:

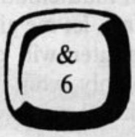
If you look at the lower left-hand corner of the keyboard you will see the keys CAPS LOCK, SHIFT LOCK and SHIFT.

On switching on, you are in CAPS LOCK, which is indicated by the little light so labelled being on (below the left-hand shift key).

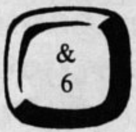
This means that all the letters of the alphabet that you type will appear in capitals, unlike a typewriter which prints in lower case unless you hold down the shift key.

While CAPS LOCK is on, pressing a key with two characters marked on it will cause the lower character to appear on the screen. To obtain the upper character, press the key while at the same time holding SHIFT down.

For example, pressing



will give you 6 on the screen while pressing



and [Shift] will give you & on the screen.

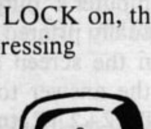
Here I introduce a convention: If I want you to press two keys at the same time, I join these keys with +.

To enable the keyboard to function as a normal typewriter press [Caps lock]. The CAPS LOCK light should switch off. If you type now, you will find that the alphabet appears as lower case unless you press [Shift] down with it, when it will appear as capitals.

Remember, if you want to get onto a new line, just press return and ignore Mistake.

Now press [Shift lock]. Its light (to the right of the CAPS LOCK light) should come on.

If you type now, the alphabet will come out in upper case because everything is shifted while SHIFT LOCK is on. This is not the same as having CAPS LOCK on, though, as you will find by pressing



which will give you & (because it is shifted).

You can't get 6 with SHIFT LOCK on. To switch it off just press [Shift lock] again.

You've probably noticed by now that most keys have an auto-repeat facility. This means that having pressed a key it will begin to print itself out repeatedly after a short delay if you keep it pressed. Try it.

At the moment the keyboard should be acting like a typewriter – with none of the lights on. If either the SHIFT LOCK or the CAPS LOCK lights are on, press the appropriate key to extinguish it.

Get onto a new line by pressing [Return] and type:

end [Return]

You should get Mistake which proves that, as far as the computer is concerned, "end" and "END" are different words. It recognises "END" as a Basic word but not "end".

This is the reason for the CAPS LOCK key. If you have this on, you automatically type in letters of the alphabet in capitals, so preventing you from mistakenly entering "end" instead of "END".

For the present I am going to assume that all your typing is done with CAPS LOCK on. If it is not on at the moment (which it won't be if you have been following), just press that key once to rectify the situation.

By now, you will have probably filled up a screenful of text and seen the scrolling action demonstrated. If not, press [Return] several times in succession or, more sophisticatedly, hold [Return] down and let the auto-repeat do the work for you.

As you'll soon see, scrolling is when the top of the screen rolls up to allow more typing at the bottom.

On computer keyboards there is a special version of Parkinson's law which states that the number of keys increases to fill the amount of space available. There are always extra features that you would like to put on a keyboard and you have to call a halt somewhere.

At some point in your computing career, though, you are bound to feel that life would be easier if, instead of repeatedly typing the same set of instructions to the computer, you could simply press a single key.

The BBC Micro allows you to tailor the keyboard to your special needs by giving you a set of nine user-defined

→

From Page 15

keys. These are the red keys at the top of the keyboard, labelled *f*0 to *f*9.

Later in this series we shall see how to instruct the computer in the meaning we wish each key to have.

There are also certain capabilities that you would like a keyboard to have which, while fairly standard, do not merit a particular key of their own – for example, clearing the screen (I'm sure you've felt the need for that already) or turning a printer on and off.

For this we use the CTRL key, where CTRL is short for control. As with SHIFT, we combine CTRL with other characters to obtain our effects.

To clear the screen use:

```
L + [Ctrl]
```

Remember that the + means we press both keys together. Also note that it produces an effect immediately. There's no need for [Return]. Try:

```
G + [Ctrl]
```

To conclude this preliminary examination of the keyboard, I suggest that you clear the screen if necessary, then type in a few letters (without pressing [Return]).

Now press [Delete] once. The last letter you typed should disappear, its position being taken by the cursor. If you keep [Delete] down, the auto-repeat will function and erase your whole line.

You can use this to correct typing errors. Simply erase back to the mistake and retype.

This is just one form of what is called screen editing. There are other ways, involving the ↑,↓,→,←, and COPY keys, but these can wait a while (as will the discussion of the ESCAPE and BREAK keys).

When you switch on the BBC Micro it is in Mode 7, as yours should now be. For a detailed explanation of this and other modes, see the article on modes on Page 26.

Briefly, the mode the micro is in affects the number of characters that can fit on the screen, the size of those characters and the number of colours displayed.

Now Mode 7 is a fine one but unfortunately in it the characters on the keys do not necessarily correspond to those that appear on the screen when you press the key.

For example, try typing { or [or /. Also try O and 0.

In this mode, the difference is hardly noticeable since 0 doesn't have a line across it. Other modes don't have this problem, so let's change mode.

On a new line, type:

```
MODE 6 [Return]
```

The screen will clear and now, when you type, you will find that the characters appearing correspond to those on the keys. We will remain in this mode for the rest of the article.

Right, it's a computer so let's get it to compute! But don't worry, this isn't going to turn into a mathematical treatise. After a brief but necessary foray into simple sums, this series is thoroughly non-mathematical.

Before we start, let me give you a warning. The computer will do exactly as you tell it but only what you tell it.

It's a very literal machine and in this respect is like my daughter on a mischievous day: When asked to put on her pyjamas for bed she did exactly as she was told. Of course, I hadn't asked her to take her other clothes off first, had I? You can imagine the results . . .

It's a computer, so let's get it to compute. But not to worry . . . the sums are simple

Similar things happen with the computer. Say we want the computer to calculate 2+2. Not only do we want it to do the sum but we want it to tell us the answer when it's done it.

We instruct the BBC Micro to write things on the screen with the Basic word PRINT. This is a relic from the days when the computer's output, as it is called, was actually printed out on paper rather than on the screen as it is now.

So, to see the answer to 2+2, type:

```
PRINT 2+2 [Return]
```

Note that you don't need the = sign as you do on a calculator. [Return] takes care of that. Before continuing try a few simple additions . . .

Just as the computer does not allow you to use O for 0, so it does not permit you to use x for multiply. The computer uses the symbol * instead. For example try:

```
PRINT 4*3 [Return]
```

Minus (–) is straightforward. You'll find it sharing a key with =. Divide, however, is not ÷ but an oblique stroke (/). For example, 12÷4 becomes:

```
PRINT 12/4 [Return]
```

Though this may seem at first a little odd to you, you have met it when dealing with fractions: 3÷4 is equivalent to the fraction 3/4. Try:

```
PRINT 3/4 [Return]
```

From now on I am going to assume that you accept that before the BBC Micro can act on your instructions, they must be sent to it by [Return]. I will therefore omit [Return] from my examples. Make sure that you don't.

Before experimenting with further sums of your own devising, I'd like you to try the following sequence:

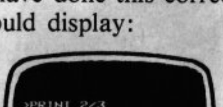
```
PRINT 2+8-3
PRINT 4*8/2
PRINT 4*8+2
PRINT 4*(8+2)
```

If you think carefully about the results you'll see that the computer interprets sequences of sums in the order you learned at school. You do whatever is inside brackets first, then multiplication and division, then finally addition and subtraction.

Now try:

```
PRINT 2/3
PRINT 1000*1000*1000
PRINT 1/100
```

If you have done this correctly, your screen should display:



```
>PRINT 2/3
0.666666667
>PRINT 1000*1000*1000
        1E9
>PRINT 1/100
       1E-2
```

The point to stress here is that the computer works to a limit of accuracy. For example, 2/3 is not exactly 0.666666667. The error is well under a millionth, though. Still, it must be borne in mind.

Similarly, with especially large or small numbers, the computer saves space by storing them using a scientific notation called Exponent format.

Here, for example, instead of printing out the answer to 1000*1000*1000 as 1000000000, it prints out the result as 1E9.

For E, which stands for Exponent,

→

SEIKOSHA GP250X

SEIKOSHA
GP-250X
STOP
RESET
ERROR
POWER

DEALER ENQUIRIES WELCOME.

Big Brother to the GP100A

programmable graphics for around £260 EX. VAT.

The Seikosha GP100A has been around long enough now to establish itself as a low cost, good quality, reliable graphics printer.

It has now been joined by the GP250X which has been developed to be the printer with the best cost/performance characteristics available.

The standard features give you a printer which enables you to enhance your computer output. The Serial and Centronics parallel output ports enable all computers to be interfaced to the printer with ease. Full service support is provided by DRG Business Machines' nationwide distributor network.

FEATURES INCLUDE:

- ● 128 characters, with decenders in ROM.
- ● 64 user definable characters in RAM (384 bytes).
- ● Programmed printing (80 bytes of memory) for storing your own print sequences.
- ● Dot addressable graphics with repetitive graphics data printing.
- ● Double width and/or double height character printing.
- ● Intermixed printing on a line.
- ● Print speed 50 characters per second.
- ● RS – 232C Serial and Centronics parallel interfaces.
- ● Selectable no. of line feed per LF command.
- ● Paper empty function and buzzer.
- ● Selectable space between characters.
- ● Self test routine.

DRG BUSINESS MACHINES

Telephone the number below and we'll tell you where your nearest distributor is located.
See the remarkable Seikosha GP250X in action.

(Peripherals & Supplies Division) 13/14 Lynx Crescent, Winterstoke Road,
Weston-super-Mare, BS24 9DN. Tel: (0934) 416392.

THE FINEST WORLDWIDE SUPPORTED NATIONWIDE.

DRG (UK) Ltd, Reg No. 22419 England.

WATFORD ELECTRONICS

DEPT BBC, CARDIFF ROAD, WATFORD, Herts, England
Tel Watford (0923) 40588. Telex: 8956095

MAIL ORDER AND RETAIL SHOP. TRADE AND EXPORT INQUIRIES WELCOME. GOVERNMENT AND EDUCATIONAL ESTABLISHMENTS OFFICIAL ORDERS ACCEPTED. Carriage: unless stated otherwise, please add min. 50p to all cash orders). **VAT** APPLICABLE TO UK CUSTOMERS ONLY. ALL PRICES EXCLUSIVE OF VAT. PLEASE ADD 15% VAT TO THE TOTAL COST INCLUDING POSTAGE. SHOP HOURS: 9.00am TO 5.00pm MONDAY TO SATURDAY. AMPLE FREE CAR PARKING. ACCESS ORDERS: Simply telephone through your order on Watford 50234/40589.

BBC MICROCOMPUTER

Model A £299; Model B £399

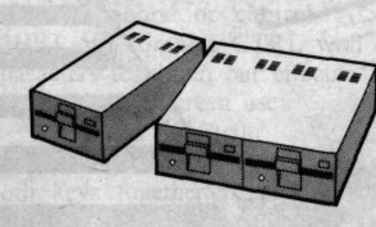
incl. VAT (carr £7)

UPGRADE KITS. Upgrade your Model A to Mod. B with our Upgrade Kits and save yourself £ s s s . . . . . .

● BBC1 16K Memory (8 × 4816AP-3 100nS)	£16.00
● BBC2 Printer User I/O Port	£8.20
● BBC3 Disk Interface Kit	£65.00
● BBC4 Analogue I/O Kit	£6.75
● BBC5 Serial I/O Kit	£7.50
● BBC6 Expansion Bus Kit	£6.50
● Printer Cable Ready made 36"	£12.00
● Complete Upgrade Kit Mod. A to Mod. B	£48.00

Complete range of Connectors & Cables available for BBC Micro. Send SAE for list.

DISC DRIVES 'TEAC' BBC Compatible



● US50A—Uncased, Single sided, 40 track, 5¼", 100K	£125
● CL50A—Cased, Single sided, 40 track, 5¼", 100K	£150
● Power Cable for above Discs	£12
● CS50A—Cased with own Power Supply, S/S 40 track, 5¼", 100K	£180
● CD50A—Twin Cased with own PSU, Single sided, 40 track, 5¼", 200K	£350
● CS50E — Single Cased with own PSU, Single Sided, 80 track, 5¼", 200K	£250
● CD50E — Twin cased with own PSU Double sided 80 track, 5¼" 400K	£475
● CD50F — Twin Cased with own PSU, Double sided, 80 track, 5¼", 800K	£599
● FD50F—Twin cased with own PSU, Double sided, 80 track, 5¼", 800K	£725
● Single Drive Cable for BBC Micro	£8
● Twin Drive Cable for BBC Micro	£12
● 10 Verbatim Diskettes, 5¼", S/sided	£18
● 10 Verbatim Diskettes, 5¼", D/Sided	£30

ACORN AP100A BBC PRINTER

10" Tractor Feed, 80 Columns, 30 CPS normal & double width Char. Dot res graphics

Parallel Interface Std. Our price includes *FREE* 500 SHEETS of PAPER
Only **£175** (£7 carr)

- SEIKOSHA GP250X 10" Tractor Feed, 80 col. 50 CPS, normal & double width & height characters, RS232 & Centronics Interfaces standard. **£235** (£7 carr)

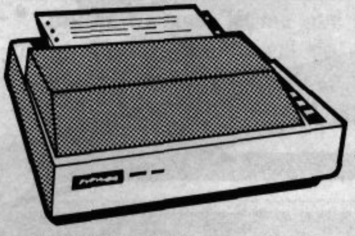
Printer Cable to interface above printers to BBC Micro **£11**

NEC PC8023BE-C

100 CPS, Bi-directional, logic seeking, 80 columns, 7 × 9 Dot matrix, superscript & subscript, hi-res block graphics, underlining, true descenders, Tractor/Friction feed, Reverse linefeed, 2K Buffer, proportional spacing, attractively finished **£320** (£7 carr)

Interface Cable for BBC Micro **£12**

EPSON



Our price includes FREE 500 Sheets of Paper

MX80FT/3

10" Tractor & Friction feed, 9 × 9 matrix, 80 col., speed 80 cps, Bi-directional, hi-res bit image graphics. Subscript & superscript, Italics & underlining. Only **£324** (£7 carr)

Printer Interface Cable for BBC **£12**

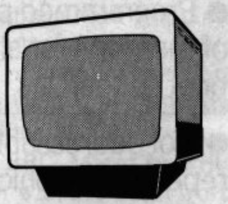
MX100FT/3

15" Carriage, 136 columns, plus all the facilities of MX80FT/3 Only **£425** (£7 carr)

LISTING PAPER

8½" × 9½" Fanfold paper plain or ruled (1000 sheets) **£7** (150p carr)
15" fanfold paper (1000 sheets) **£9** (150p carr)

MONITORS



MICROVITEC 1431. 14" Colour Monitor. RGB Input. (as used in BBC Prog.)
Price including connecting Lead **£249.95** (carr £7)

BMC BM1401 14" Colour Monitor R.G.B. Input **£165** (car £7)

ZENITH 12" Green Monitor. Excellent res. **£80** (carr £7)

CASSETTE RECORDER & ACC.

Top quality Sanyo Slim-line, portable Cassette Recorder. Ideal for Computer use. Mains/Battery operated. **£24** (carr £7)

C12 Computer Grade Cassettes in library cases **40p**

Cassette Interface LEAD for BBC

DIN Plug to 3 JACK Plugs	£2
DIN Plug to DIN + JACK Plug	£2

BBC SOFTWARE

(N.B. All Software is copyrighted)

ASTEROID BELT: (32K) Arcade type Space game. Destroy the cloud of Asteroid surrounding you with your photon belts **£7.95**

BEEBTREN: (16/32K) A realtime advanced Startrek Game. Facilities incl. 'Probe Satellite', 'damage report' & 'On board Computer'. **£6.95**

CHARACTERS: (16/32K) Makes redefining of Invaders, Foreign Characters, technical symbols etc, character shapes simpler. Clumsy Binary & Hexadecimal notations are not req. any more. **£5.80**

CHESS: (32K) Machine Code. An excellent game of enormous range of skill levels with wide variations. Uses high resolution colour graphics. **£9.95**

DISASSEMBLER: (16/32) Machine code. Ideal for discovering workings of MOS & BASIC. Invaluable for Ass. Lang. Programmer. **£5.80**

GALACTIC INTRUDER: (32K) Another arcade style game with hi-res colour & sound effects (Machine code) **£6.25**

HITCH-HIKER: (32K) An adventure game based on "Hitch-hiker's guide to the Galaxy". A fascinating game that tests your skills & wits. **£5.85**

MASTER MIND: 16/32K Mastermind game with a difference. Gives more fun (& frustration) than the original version. **£5.80**

POLAR BEAR: (32K) Educational game for 8-12 years old. Incorporates simple maths tables. **£6.50**

SPACE KINGDOM: (32K) Travel round the universe capturing and colonising Star systems to become the galactic ruler. **£6.95**

SNAKE: (32K) An arcade type game. Gives hours of fun. One of the best games available for this machine. Try it for yourself. **£7.80**

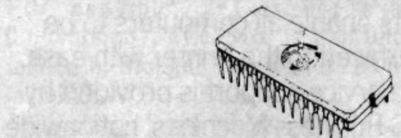
SOUND IDEA: (16/32K) A utility program for those interested in the sound and envelope facilities of BBC Micro. **£5.80**

ZOMBIE'S ISLAND: (32K) Fight for your survival on this dangerous island inhabited by hungry and ferocious cannibals. (Basic & Machine code program) **£6.95**

BUSINESS SOFTWARE	
DATABASE	£17.35
HOME ACCOUNTS	£17.35
CHARACTER GENERATOR	£17.35
MAILING LIST	£17.35
STP	£17.35
COMMERCIAL ACCOUNTS	£17.35
STOCK CONTROL	£17.35
INVOICES & STATEMENTS	£17.35

BOOKS	
30 hour basic for BBC	£5.50
6502 Assembly Lang. Programming	£12.50
BBC Micro revealed	£8.00
Instant BBC Micro Machine Code	£5.00
Let your BBC Micro teach you to program	£6.50
Practical Programs for BBC & Atom	£6.90

(N.B. No VAT on Books)



WORDWISE Model B
Without doubt the most sophisticated piece of software yet written for the BBC Micro. Wordwise contains all the usual word processing features enabling characters, words, sentences or any defined section of the text to be deleted, moved or copied from one part to any other part of the document. The more complex facilities such as search and replace or file handling commands are menu driven so that even a beginner can understand how to operate them. Wordwise will work with whatever filing system is currently implementated. Supplied with full fitting instructions and a spiral bound manual. We believe this word processor compares favourably with those costing many times as much.

£39.00 + £1.50 p&p + VAT
Technical details and order form are available from the address above.

From Page 16

you should read "multiplied by 10 to the power of". For example, 1E9 means "1 multiplied by 10 to the power of 9" which, if your maths is up to it, gives you the correct answer.

Similarly, the answer for 1/100 was returned as 1E–2 which reads as "1 multiplied by 10 to the power of –2" which is 0.01, the correct answer.

If you don't follow all of this, don't worry. I've only covered it in this article to warn you about odd looking results to your sums which might pop up and confuse you.

For those who wish to go more deeply into the area, we will be covering it in a future Bits and Bytes article. As promised, the rest of this series has very little mathematics at all.

Now, let's try to get the computer to print out some words. Let's get it to print out Hello.

If you cast your mind back to your schooldays (and for some of us that's an awful long throw), you'll remember that when someone says something you surround what that person says with quotation marks (or quotes, for short), such as: He said, "Hello."

In Basic, of course, we don't say words, we PRINT them, but we do surround them by quotes. We omit, however, the comma and full stop. Try:

```
PRINT "Hello" [Return]
```

and the computer should print out:

```
HELLO
```

Notice that the quotes are not printed.

So, to get the BBC Micro to print out a message on its screen, we just use PRINT followed by the message surrounded by quotes. The message inside the quotes is called a string, or a string literal. The latter is because the computer prints out literally, or exactly, what is between the quotes. So:

```
PRINT "Hello"
PRINT " Hello"
PRINT "  Hello"
```

give different outputs since in each, different numbers of spaces precede the Hello.

Actually, strings do not have to be words. They can be any combination of symbols, including numbers. Just keep them in quotes. Try the following:

```
PRINT "4*3"
PRINT 4*3
```

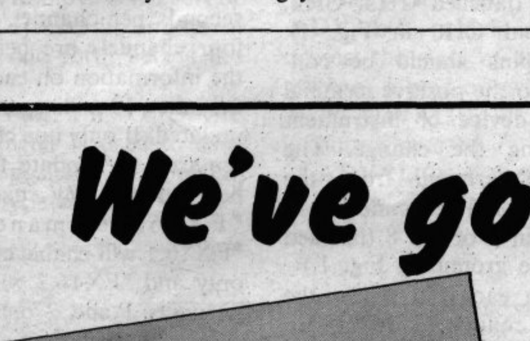
This should convince you that the computer does print out strings (i.e. what is between the quotes) literally. When the calculation is in quotes the computer simply echoes the sum on the screen. When the calculation is not in quotes, the computer prints out the answer.

Experiment with printing out various messages on the screen. How long can you make them? Try lower case words as well.

At the moment the computer is responding to our commands as soon as we send them by pressing [Return] but in a calculation or task requiring several steps this can be rather tedious.

It would be more satisfactory to give the computer a whole sequence of instructions that it could get on with rather than spoon-feed it step by step. This is possible.

Such a sequence of instructions is called a program, and we shall begin writing programs in next month's instalment. ▪



We've got it all taped!

A cassete tape of all the programs printed in this issue of BBC Micro User – a total of 22 complete listings – is available to readers.

Now you can save yourself the trouble of keying in the programs – and ensure they are all error-free. *And it only costs £3.25, plus 50p post and packing.*

The programs include: DEATH WATCH, a superb arcade game that challenges you to use your skill to fight off enemy battleships, tanks and helicopters; BINGO, illustrating clever uses of the randomise function; BUBBLESORT routines; TESTS for function keys in machine code routines; a useful CASSETTE BUGS FIX for users with OS 0.1 . . . and many COLOUR AND GRAPHICS ROUTINES to help you *create a kaleidoscope of screen designs which you can incorporate in your own programs.*

POST TO:
Database Publications,
Europa House, 68 Chester Road,
Hazel Grove, Stockport SK7 5NY.

ORDER FORM

Please supply one cassette tape of programs from the March 1983 issue of BBC Micro User.
I enclose cheque/P.O. for £3.75. Alternatively please debit my Visa/Access/Diners Club/ Eurocard* account No.
☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ * Delete as appropriate

Signature ....

Name ....

Address ....

.... *Allow 28 days for delivery*

Build your own

It's quite easy with MIKE SHAW's step-by-step guide

THE analogue to digital converter on the BBC microcomputer provides a rather simple way to connect, or interface, the computer to the outside world.

This means that you can fit the micro with joysticks for games programs, or use it to receive information from temperature sensors, light detectors, laboratory instruments, etc.

Don't let its technical sounding name put you off, for as this article will show, the analogue to digital converter (A/D for short) is pretty straightforward to use.

For a start we will concentrate on the how of using it and leave the details of what an A/D converter is and its workings to another issue.

Even if you fail to follow all the reasoning below, you should still be able to build, for example, a working games paddle and use it in a program.

Also, don't let the fact that the A/D is only fitted as standard on model B computers put you off. On Page 50 Mike Cook gives full details of a simple (and cheap) model A to B upgrade. And if you don't feel up to the whole upgrade you'll still be able to fit an inexpensive A/D converter.

Technical details first. The converter provided on the BBC model B has four channels – it can receive electrical information from four different sources.

The converter is accessed via the back of the computer through a 15 way D socket labelled "Analogue In". In order to use the A/D converter you need a suitable 15 way D plug and some, preferably screened, cable (readily obtainable from dealers advertising in this issue.)

Changing

Each of the 15 pins has a function, as shown in Fig. 1.

The information fed into the A/D interface should be in the form of a DC voltage in the range 0-1.8 volts. Very small voltage changes, or voltage changes greater than 1.8 volts, would need to be changed to bring them within the correct range.

Sensing

The four pins used to sense voltage changes are 4, 7, 12 and 15 (labelled CH3, CH1, CH2 and CH0 in Fig. 1). These pins should be connected to the positive terminal of the device or instrument producing the change. The negative terminal from the device should be connected to either pin 5 or pin 8 (labelled analogue ground in Fig. 1.)

When each pin senses the voltage change it produces a number in the range 0 – 65520 in steps of 16. Zero volts produces a number 0 and 1.8 volts produces a number 65520. In order to use this number BBC Basic provides the ADVAL command.

The general form of this command is

X = ADVAL(Z)

where X is the variable and Z is the channel number. So if the device were connected to pin 4 (channel 4) a Basic program to read the device could be

```
10 LET X = ADVAL(4)
20 PRINT X
```

If the device were connected to pin 7 (channel 2) that program would become

```
10 LET X = ADVAL(2)
20 PRINT X
```

Each channel is read in turn. This takes 10 milliseconds per channel, so if all four channels are being used the information on each channel takes 40 milliseconds to be updated. If only one channel is required the update time can be reduced by using the *FX16 command. e.g. *FX16,1 will enable channel 1 only and *FX16,2 will enable channels 1 and 2 only.

More information about the *FX commands can be found in the User Guide.

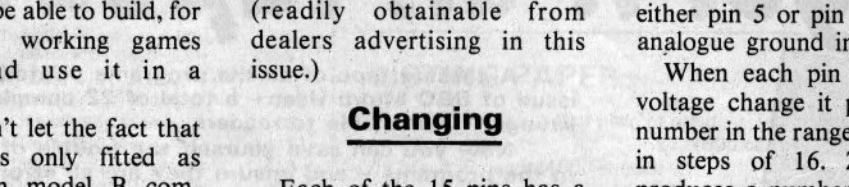
If only one channel is being used this permits relatively quick changes – occurring every 10 milliseconds – to be monitored.

Monitoring

One relatively simple way of using the A/D converter is to monitor input from a simple games paddle. Connect up a 10kohm spindle type potentiometer as shown in Fig. 2: A linear potentiometer is better and gives more predictable results than a log type.

In this example one of the VREF (voltage reference) lines is used as a supply, giving a maximum of 1.8 volts.

Each time the spindle of the potentiometer is turned and channel 1 read using PRINT



NB: This is viewed looking into the BBC computer.

1. +5 volts
2. 0 volts
3. 0 volts
4. CH3 (channel 4)
5. Analogue ground
6. 0 volts
7. CH1 (channel 2)
8. Analogue ground Fig. 1.
9. LPSTB (light pen strobe)
10. PB1
11. VREF 1.8 volts
12. CH2 (channel 3)
13. PB0
14. VREF 1.8 volts
15. CH0 (channel 1)

Figure I

games paddle

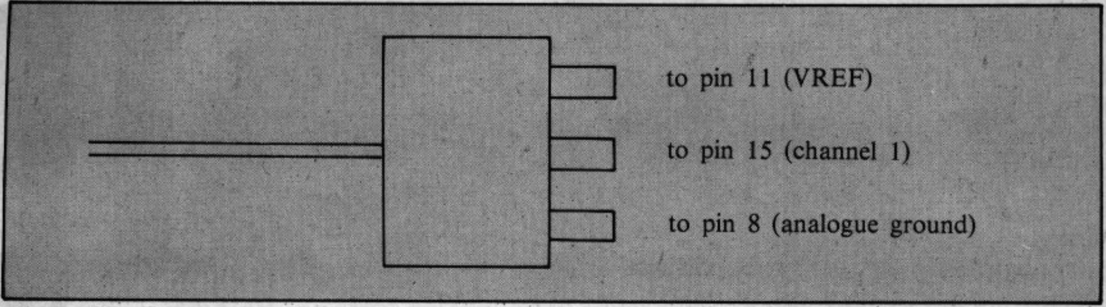


Figure II

ADVAL(1) a different number should be produced varying from 0 to 65520.

In this way a very simple games paddle can be made and used to move some sort of graphics symbol up and down or back and forth across the screen.

In Program One the potentiometer is used to control the position of a space-invader type shape:

Program Two is a variant of Program One which uses a form of ADVAL we haven't met yet to allow us to add a "fire" button to our games paddle. The new form is ADVAL(0), which allows us to test the state of closure of each of a pair of switches:

If ADVAL(0)=0 then no button pressed

ADVAL(0)=1 then button 1 pressed

ADVAL(0)=2 then button 2 pressed

ADVAL(0)=3 then both buttons pressed

To use this command it is necessary to connect together PB1 (pin 10) and 0 volts (pins 2, 3 or 6) OR PB0 (pin 13) and 0 volts (pins 2, 3 or 6.)

For example, if PB1 and 0 volts were connected then ADVAL(0) would give 2.

If PB1 and 0 volts were connected then ADVAL(0) would give 1.

If you have the 1.0 operating system then the form of the ADVAL(0) command is slightly different. To see which button has been pressed, you use

ADVAL(0) AND 3

which gives the same replies as ADVAL(0) on the 0.1 operat-

Line 40 selects MODE5 and VDU5 joins the text and graphic cursors.

Line 60 defines the character to be moved.

Line 80 obtains the horizontal position of the character using the ADVAL function. The actual number produced is divided by 55 to scale it to fit the screen graphic coordinates.

Line 100 prints the character on the screen.

Line 110 is a short delay loop.

Line 120 deletes the character.

Line 130 the loop will repeat until the S key is pressed.

Line 140 "undoes" the effect of VDU5 with VDU4.

```
 10 REM ********************
 20 REM *** PROGRAM ONE ***
 30 REM ********************
 40 MODE 5: VDU 5
 50 Y%=50
 60 VDU 23,224,24,60,60,60,60,66,129,129
 70 REPEAT
 80 POSITION=ADVAL(1)/55
 90 MOVE POSITION,Y%
100 VDU 224
110 FOR WAIT=1 TO 200:NEXT WAIT
120 VDU 127
130 UNTIL INKEY$(0)="S"
140 VDU 4
```

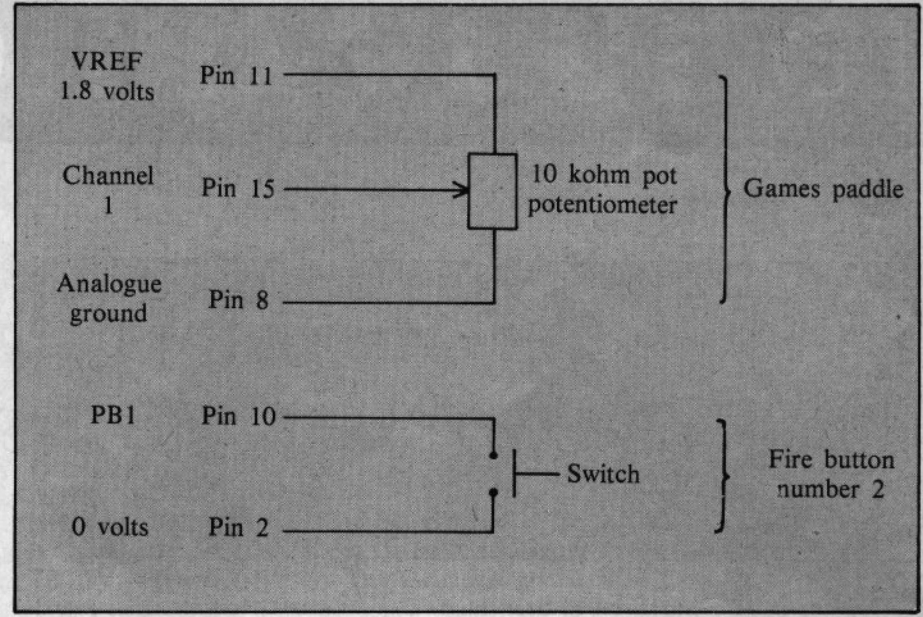


Figure III

```
 10 MODE6
 20  REM *******************
 30  REM *** PROGRAM TWO ***
 40  REM *******************
 50  MODE 5:VDU 5
 60  Y%=50
 70 VDU 23,224,24,60,60,60,60,66,129,129
 80  REPEAT
 90  GCOL0,1
100  POSITION=ADVAL(1)/55
110  MOVE POSITION,Y%
120  VDU 224
130  FOR WAIT = 1 TO 200:NEXT WAIT
140  IF ADVAL(0)=2 THEN PROCFIRE
150  VDU 127
160  UNTIL INKEY$(0)="S"
170 VDU4:END
180  DEF PROCFIRE
190  GCOL0,2
200  SOUND 1,-15,RND(255),5
210  XCOORD=RND(1000):YCOORD=RND(1000)
220  MOVE POSITION+28,Y%+16
230  PLOT 21,XCOORD,YCOORD
240  FOR WAIT=1 TO 500:NEXT WAIT
250  MOVE POSITION+28,Y%+16
260  PLOT 7,XCOORD,YCOORD
270  MOVE POSITION+64,Y%
280  ENDPROC
```

From Page 21

ing system. Also ADVAL(0) DIV 256 can be used to find out which channel was the last one to complete conversion. If you are not sure which operating system you have then type *FX0 and press RETURN.

This will produce a statement to tell you which operating system is resident in your computer.

A fairly simple circuit to give the games paddle plus fire button that Program Two needs would therefore be as shown in Fig. 3.

Testing

In Program Two line 140 tests to see if the button is pressed. If so it calls PROCFIRE. This plots a dotted line to a random point (line 230) and then, after a suitable delay (line 240), unplots it with line 260. The procedure also sounds a quarter second note of random pitch.

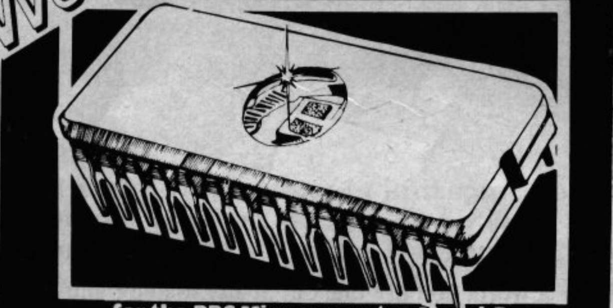
So, there you are – a cheap yet effective games paddle with firing button. Now all you need is something to shoot down – that should be easy enough to program . . .

Software for the BBC Micro

from COMPUTER CONCEPTS

Wordwise

Wordwise



for the BBC Microcomputer Model B

The word processor for the BBC machine. This ROM based word processor has received superb reviews.
Supplied with full spiral bound manual and cassette containing an example document and free typing tutor program.
Now available from stock. Quantity Discounts.
£39.00 + £1.50 p&p + VAT.

from COMPUTER CONCEPTS

Forthcoming ROMs

Beeb-calc

A ROM based spread sheet program.

Debugging Program

2 machine code debugging programs — one in ROM, one on tape. Essential for the machine code programmer. An ideal complement to the assembler built into the BBC machine.

Disk Doctor

A ROM containing useful disk utility programs. Enables the recovery of any data off the disk including deleted files etc.

Available Soon!
SEND FOR DETAILS

from COMPUTER CONCEPTS

Games

FOR THE MODEL B.

NEW!

SWARM
Alien against you, mode 2 graphics. Very fast. £7.80 + VAT.

Spacehawks

Mode 2 graphics, a machine code game much like the 'Galaxians' found in the arcades — very fast and also works with joysticks.

£7.80 +VAT

Asteroid belt

High speed and high resolution graphics are combined in this game to produce an exciting game — almost identical to the original arcade version.

£7.80 +VAT

Chess

High resolution graphics with thousands of skill levels — more features than any other chess game.

£10.00 + VAT.

Snake

Another game that has received very favourable reviews – Fast and addictive.

£7.80 +VAT

We give very generous trade discounts

Cash or royalties — we pay the best rates around for any good BBC micro software.

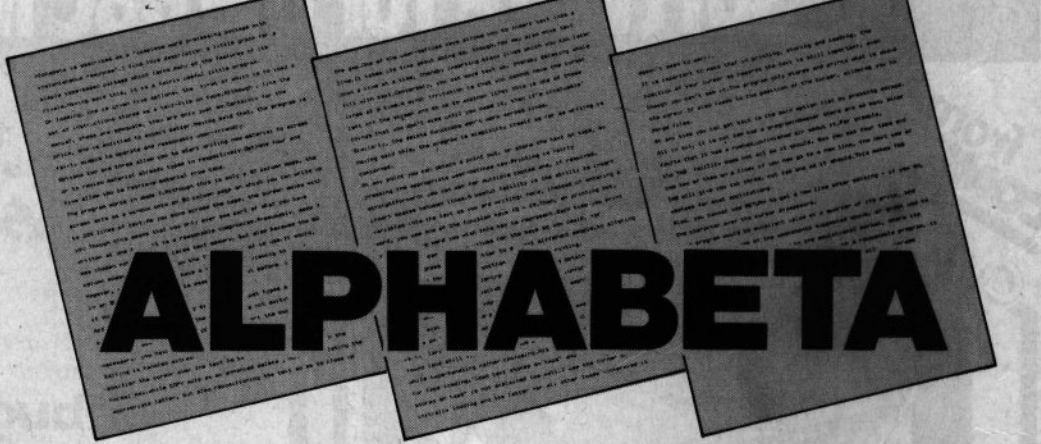
Our tapes are guaranteed to work on all Operating Systems.

COMPUTER CONCEPTS

Buy it with Access

16 Wayside, Chipperfield,
Herts, WD4 9JJ. tel (09277) 69727

BARCLAYCARD VISA



ALPHABETA

PAUL JAMES weighs up a word processor package – and finds it on the pricey side

ALPHABETA is described as a "complete word processing package with instantaneous response". I find this description a little grand for a simple tape-based package for the BBC Micro which lacks many of the features of its rivals.

Having said this, it is nonetheless a fairly useful little program.

On loading, one is given five options, the first of which is to load a set of instructions stored as a text file on tape.

Although, like the manual, these are adequate, they are only just so. Certainly for the price – £28.50 – one is entitled to expect better.

The program is fairly simple to operate and reasonably user friendly. Options two and three allow you to start writing new material to screen or to review material already typed in. Options four and five allow retrieval of material from tape.

The program works in mode 7. Although this is only a 40 column mode, the screen acts as a window onto an 80 column page on which you can write up to 224 lines of text. As one moves across the page the screen moves too.

Though this means you only ever see part of what you have written at one time, it is a reasonable compromise.

Presumably mode 7 was chosen not only to maximise text memory but also because the 80 column modes are illegible on the TV sets most of us use. It would, however, have been nice to have a facility for viewing the text in an 80 column mode so as to assess the layout before printing it out.

Actually writing text is very simple – one just types away. An annoying point is that, on loading, the program does not switch off CAPS LOCK itself, nor does it test for OS 0.1 and effect the bugs fix if necessary. You have to do that yourself.

Editing is handled extremely well. The cursor control keys allow you to position the cursor over the text to be rewritten. DELETE acts in the normal way, while COPY acts as an enhanced delete, not only deleting the appropriate letter but also repositioning the text so as to close up the gap.

One of the user defined keys allows insertion of text into a line. It takes its time about doing so, though. You may also move text down a line at a time, thereby inserting blank lines which can later be filled with text. Conversely, you can move text up, thereby deleting whole lines at a time.

A minor irritation is that you cannot move the cursor left off the screen and so up to another line. This is one of those things that you don't miss until you need it. Then it's invaluable!

Similarly, the delete functions don't work across lines. Having said this, the program is simplicity itself as far as writing is concerned.

At any point you can obtain a printout, or store the text on tape, by pressing the appropriate user defined key. Printing is fairly straightforward. You can ask for multiple copies and, if required, insert spaces between lines.

A useful facility is the ability to insert variables into the text while writing. Here, instead of entering a word, you use one of the function keys *f*5 – *f*9. On printing out you choose the word you wish this key to represent.

Each time you print the text you can pick new values for the keys, so you could, for example, address the same letter to several different people by altering the value of the relevant function key at each printing.

The program allows centred headings and double width characters, if these are available on the printer. Unfortunately it is incapable of allowing one to generate the more sophisticated effects available on some printers.

Storage on tape takes two forms – bulk storage and named files. The former is for large files, the latter for smaller files which may be merged.

I found (and still find) the various prompts that come on the screen while tape-handling rather confusing.

Also the use of the two options for tape loading, "load text stored on tape" and "load further text stored on tape" is not explained too well.

I use the former when initially loading and the latter for all other loads (otherwise it doesn't seem to work).

It is important to note that in printing, storing and loading, the position of the cursor in relation to the text is still important, even though you can't see it. The program only stores and prints what is above the cursor. It also loads to the position of the cursor, allowing one to merge files.

At any time you can get back to the main option list by pressing ESCAPE.

All in all, it is not too bad a program. However there are so many minor faults that it has a rushed, unfinished air about it. For example, the TAB facility does not act as it should.

Say you set four tabs and use two of them on a line, if you now go to a new line, the next use of TAB will give you tab three, not tab one as it should. This makes TAB useless for most applications.

Also you cannot use RETURN to get a new line after editing. If you do the character over the cursor disappears.

This program would be excellent value at around half its price, and would be, with some of the amendments suggested above, of great use to tape-based users, especially in the educational market, where its simplicity would be welcomed.

As it is, although a reasonable program, it is hopelessly overpriced when compared to other, similar programs now available.

WIN this superb BBC colour monitor!

OUR tame programmer is in disgrace again. We asked our resident genius, as he likes to be known, to write something to illustrate the BBC Micro's fantastic graphics capabilities – you can see the results for yourself in Figures I and II.

Unfortunately, we'd only just managed to take the snaps of the screen with our ever-handy instamatic when the power went! Of course we cannot blame him for that. But, would you believe, the idiot hadn't kept a back-up copy. Worse still, there was no listing, and now he can't remember how he did it . . .

Can you help?

What we'd like you to do is to reconstruct his program for us – as accurately as possible, colours and all. Figure 1 shows how the finished program should look and Figure 2 shows the picture in the process of being built up, if that's of any help to you.

Once you think you've got it right, send a legible listing of your program, together with the coupon below, to BBC Micro User. Mark your envelope clearly "CONTEST".

Don't take too long, though. Entries close on March 31. On that date we shall select as winner the program that most accurately reproduces Figure 1. In the event of a tie, we shall draw for the winner.

And your rewards for all this effort? The superb BBC colour monitor, kindly supplied by Microvitec. It's the one we've used for the pictures on this page, so you'll have a display to match the brilliance of your programming!

As for our 'resident genius', if he ever does anything like this again, we'll take his BBC Micro away from him and make him work on a Spectrum – that should teach him . . .

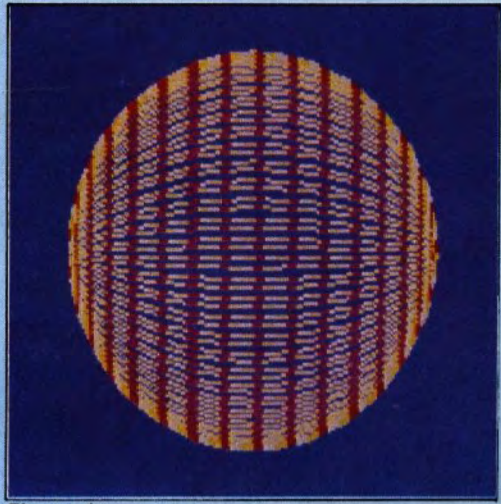


Figure 1.

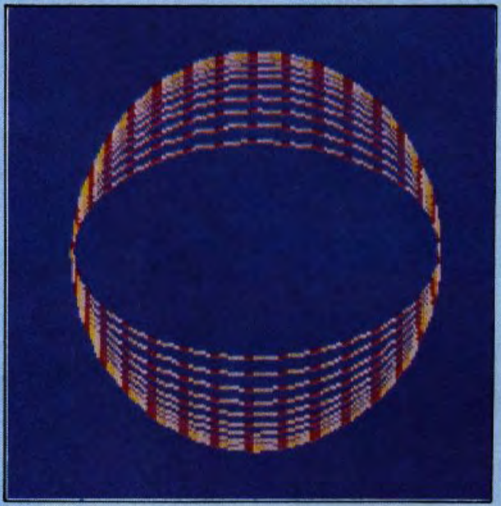


Figure 2.

START WRITING YOUR PROGRAM NOW!

The last date for the receipt of entries is March 31, 1983.

The result of the contest will be given in the May issue of BBC Micro User.

Your FREE entry form

My listing for the BBC colour monitor competition is enclosed.

Name ....

Address ....

....

....

Tel: No. ....

POST TO: BBC Micro User, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY.

THE wide range of colour and graphic commands available on the BBC Micro make it an exciting and powerful machine to use. For the first-time user, however, this variety of commands can be rather overwhelming. In this and following articles we shall be taking a gentle but instructive look at the way text colours and graphics are handled. One area that often confuses newcomers to the machine is that of modes, so let's start there.

A touch of the Van

Add some colour to your computing career with this first of a series of articles on elementary use of colour, text and graphics, by PAUL JONES

THE BBC Micro has eight different modes, MODE 0 to 7. The mode you are in effectively decides how many characters you can display on the screen and in how many colours.

Now when a microcomputer is designed, memory has to be allocated carefully. The more characters you have per line (cpl) the more memory it takes. Similarly, the more colours you use, the more memory it takes to remember them.

Because of the limited amount of memory available, a compromise has often to be made between the number of characters per line and the number of colours available to the display – and, as often happens with a compromise, you get the worst of both worlds.

Useful options

In this, as in so many areas, the BBC Micro offers options that the others do not. By choosing between the various modes you can trade off the number of colours available against the number of characters displayed and so, hopefully, obtain the optimum for a particular need.

Figure I displays the characteristics of the various modes. It is such a useful table that we have provided you with one on the cover of this month's issue to use as a ready reference.

Before going further let's "dispose" of MODE 7, the teletext mode, which is the one the computer is in when first switched on. This mode is organised in a totally different way to the others, so, for the purposes of this article, it is "out of context". We are concerned with MODE 0 to MODE 6.

This is not to discount MODE 7: It is very valuable, as an examination of Figure I discloses. It can display 40 cpl in 16 colours and yet only uses 1k of memory.

The only other mode to display 16 colours is MODE 2, and that only has 20 cpl and uses a massive 20k. The drawback is that teletext is not a graphics mode, i.e. you aren't able to use BBC Basic's advanced graphic commands. This does not mean that you cannot use teletext to draw some effective pictures – you can, as Ceefax and Oracle, which also use MODE 7 format, demonstrate.

If we now examine modes 0 to 6 in Figure I we can see clearly the cost, in terms of memory, of increasing either the number of colours or of characters. MODE 3 and MODE 6 are both text-only modes, which, as in MODE 7, means that the graphic commands are not available. Both support only two colours.

Notice that while MODE 6 supports only 40 cpl, MODE 3 supports 80 cpl. This doubling of characters, however, necessitates an increase in memory required by the screen from 8k to 16k.

Similarly, if we look at the two four colour modes (i.e. MODE 1 and MODE 5) we find that MODE 5, which has only 20 cpl, uses 10k, while MODE 1, which supports double the characters (40 cpl) uses double the memory – 20k.

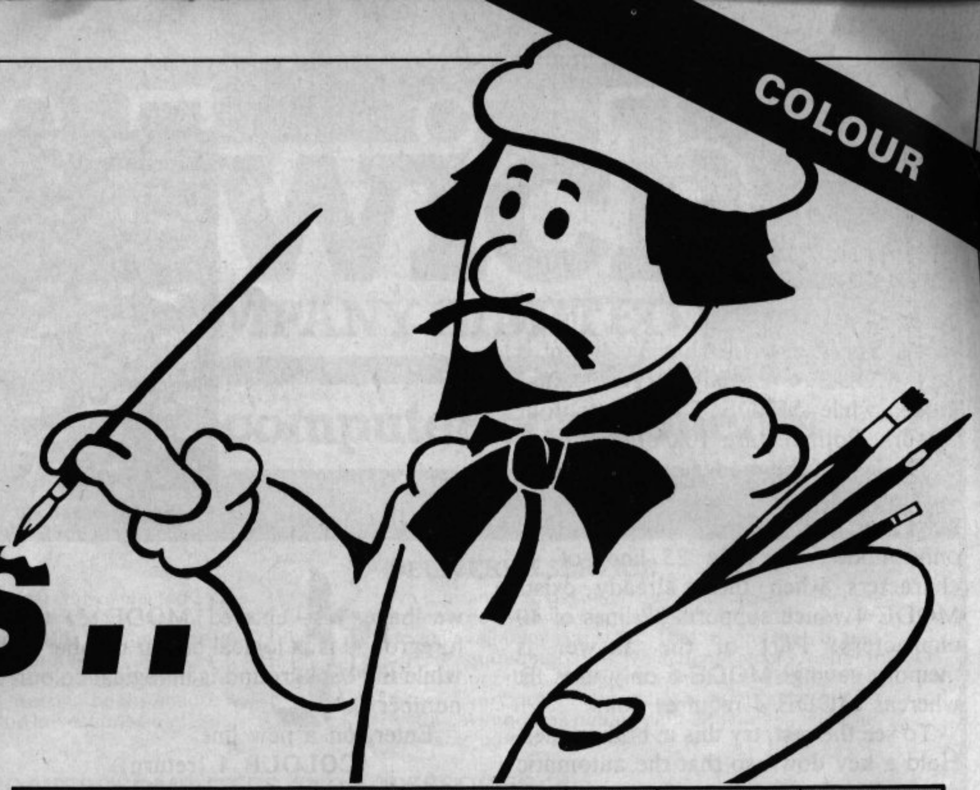
The two colour graphics modes, 0 and 4, show a similar pattern. This time, though, because you have fewer colours, MODE 4 can display 40 cpl using 10k of memory, while MODE 0 displays 80 cpl using 20k.

From the Memory Used column of Figure 1, it can be seen that MODES 0, 1 and 2 need 20k for their display, while MODE 3 requires 16k, hence these modes cannot be used on the standard model A, which has only 16k of RAM fitted. The remaining modes (4, 5, 6, 7), which use less memory, are available on both models A and B.

From Figure I it can be seen that the modes fall into three categories of two, four and sixteen colours. You must remember, however, that one of the colours available is the background colour – for example, in a two colour mode you do not have two colours to write on, say, a black background. If you want a black background, that's one of your two colours, leaving you only one colour to write on it with.

Colour pairs

Also to say that there are 16 colours available on the BBC Micro is slightly misleading. There are, in fact, only eight separate colours – black, red, green, yellow, blue, magenta, cyan and white. As an investigation of Figure II will



Goghs..

show, the other colours are made up of pairs of these colours, flashing alternately.

As Figure II shows, in the four colour modes (MODE 1 and MODE 5) the colours available are black, red, yellow and white. This is only the "default" situation on entering a mode. You can, if you choose, display any of the 16 colours available, but you are restricted to displaying a maximum of four of these colours on the screen at any one time.

Similarly, the two-colour modes have black and white as their colours on entry, but you can select any two colours from the palette of 16. You could, say, write in white on a blue background.

Into action

Enough theory – let's get some hands on experience. So switch on your computer. At power on, the machine is in MODE 7. To change mode you simply type MODE followed by the relevant number, e.g. to enter MODE 5 type:

MODE 5 [return]

where [return] means "press the RETURN key".

The first thing you'll notice is that the screen clears leaving the prompt and the flashing cursor at the top left-hand corner of the screen. You cannot change mode without clearing the screen.

Try typing in a few letters at random to see the chunky set of letters MODE 5 gives you – remember it has 20 cpl. Press RETURN, ignoring any error messages, and enter:

MODE 4 [return]

Again, the screen should clear. Try typing a few letters this time. Immediately it should become apparent that the characters are of more normal

MODE	Graphics resolution		No. of colours	Text		Memory used	Smallest plotable point or pixel (gu)	Character size (gu)
	hor.	vert.		char.	lines			
0 †	640	256	2	80	32	20k	■ 4 2	A 32 16
1 †	320	256	4	40	32	20k	■ 4 4	A 32 32
2 †	160	256	16	20	32	20k	■ 4 8	A 32 64
3 †	text only		2	80	25	16k		
4	320	256	2	40	32	10k	■ 4 4	A 32 32
5	160	256	4	20	32	10k	■ 4 8	A 32 64
6	text only		2	40	25	8k		
7	text only		16	40	25	1k		

Figure I

† model B only

MODES 0, 3, 4, 6

Logical number		Colour (on entering mode)
Foreground	Background	
0	128	Black
1	129	White

MODES 1, 5

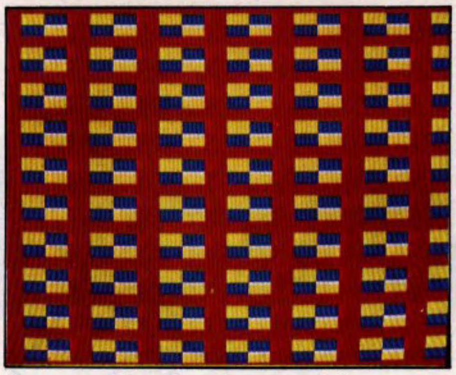
Logical number		Colour (on entering mode)
Foreground	Background	
0	128	Black
1	129	Red
2	130	Yellow
3	131	White

N.B. The logical colour numbers on entering mode 2 are also the actual colour numbers.

MODE 2 (and actual colours)

Logical number		Colour (on entering mode)
Foreground	Background	
0	128	Black
1	129	Red
2	130	Green
3	131	Yellow
4	132	Blue
5	133	Magenta
6	134	Cyan
7	135	White
8	136	Flashing black-white
9	137	Flashing red-cyan
10	138	Flashing green-magenta
11	139	Flashing yellow-blue
12	140	Flashing blue-yellow
13	141	Flashing magenta-green
14	142	Flashing cyan-red
15	143	Flashing white-black

Figure II



A tapestry based on Program III

From Page 27

proportions – MODE 4 is a 40 cpl mode. The penalty for having 40 cpl is that MODE 4 is only a two colour mode, while MODE 5 supports four colours. Both require 10k of memory.

The last of the modes available on an unexpanded model A is MODE 6. It may seem odd to have this special text-only mode with only 25 lines of 40 characters when there already exists MODE 4 which supports 32 lines of 40 characters. Part of the answer is memory saving: MODE 6 only uses 8k whereas MODE 4 requires 10k.

To see the rest, try this in both modes. Hold a key down so that the automatic repeat functions until you have a couple of lines filled with characters. You should be able to see that in MODE 6 the lines are separated, making for greater legibility. If you are fortunate enough to have the extra memory you can experiment with the size of characters in the other modes (0, 1, 2 and 3).

Better separation

MODE 2 gives 20 cpl as did MODE 5, but offers you 16 colours instead of four. MODE 1 offers you four colours, as did MODE 5, but with double the number of characters per line. MODE 0 offers you only two colours, but with 32 lines of 80 characters – while MODE 3, a text-only mode, provides 25 lines of 80 characters with better separation and using 4k less memory than MODE 0. (On many TV sets it will be rather hard to read the 80 character modes – monitors function better.)

Let's return to MODE 5 with

MODE 5 [return]

This is a four colour mode. On entering such a mode the colours available are

0 black
1 red
2 yellow
3 white

As you can see, each number has a colour associated with it – the logical colour number. *(It must be stressed that the colour associated with a logical colour number is not fixed – you can alter things so that logical colour number 2 refers, say, to blue. We shall see how to do this later in the article.)*

On entering any mode, if you type something, it will appear in white on a black background. The colour the characters appear in is called the foreground colour. In this instance, since we have just entered MODE 5, the foreground is in logical colour number 3, while the background is in logical colour number 0.

Enter, on a new line,

COLOUR 1 [return]

Now type some letters – the characters will now appear in logical colour 1 which is red. The effect of COLOUR followed by a number is to change the foreground logical colour number to the number specified. For example,

COLOUR 2 [return]

will make subsequent typing appear in logical colour 2 which is yellow while

COLOUR 3 [return]

will restore the foreground colour to white. You can, if you wish, try

COLOUR 0 [return]

This changes the foreground colour to black (logical colour 0). However, as the background is also black, there is no contrast between the characters and their background – hence you cannot see what you are writing! To return to normality you must either type in a command to change the foreground colour very carefully (since you cannot see what you are doing) or, more drastically, press BREAK, which will return the screen to MODE 7.

Do experiment

Of course we can use black as our foreground colour provided we write on a contrasting background. To change the background colour of the characters we must again use COLOUR, but this time followed by the logical colour number *PLUS* 128. This addition of 128 tells the computer that the logical colour number combined with it refers to the background colour, e.g. COLOUR 129 will cause subsequent characters to be printed out on a red background since 129=128+1 and logical colour number 1 is, at the moment, red.

Experiment with different fore and background combinations. Notice that when you change the background colour, only the backgrounds of subsequent characters are affected. Earlier characters retain their previous background colours. If, however, you type CLS after a change of background colour, the screen will be cleared to that background colour. So

COLOUR 130:CLS [return]

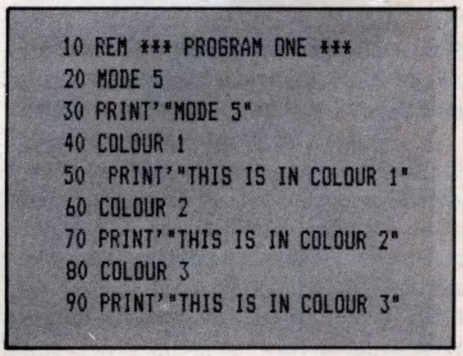
will give you an empty yellow screen while

COLOUR 2:COLOUR 129:CLS [return]

will give you a red screen on which text appears in yellow.

That is enough new information for the moment, let's try a few programs to consolidate our knowledge. Program I should help you familiarise yourself with the text colours. Instead of simply running the program, try the alterations and additions suggested.

Programs II and III are quite pretty. If you are a beginner, see if you can follow what is going on. If you are past the beginning stage, but not yet an expert, try adapting the programs as suggested – you may find the problems posed rather testing.



```
10 REM *** PROGRAM ONE ***
20 MODE 5
30 PRINT'"MODE 5"
40 COLOUR 1
50  PRINT'"THIS IS IN COLOUR 1"
60 COLOUR 2
70 PRINT'"THIS IS IN COLOUR 2"
80 COLOUR 3
90 PRINT'"THIS IS IN COLOUR 3"
```

Program I

Run this program. As you can see it prints out three of the colours available for text on entering MODE 5. Actually there is another colour. Try adding

100 COLOUR 0
110 PRINT "THIS IS IN COLOUR 0"

Can you explain, and recover from, the results of this? Also, try changing the

Midwich

COMPUTER COMPANY LIMITED

1st choice for microcomputer components

QUALITY & VALUE

Every product in our catalogue is carefully selected as being of the highest quality and is backed by our 12 month "no-quibble" guarantee. Most of our range is purchased from leading manufacturers such as Texas Instruments, Motorola, National Semiconductor, Intel etc. Our bulk buying power and low overheads ensure that these products are sold at the lowest possible, often unbeatable prices.

DELIVERY & SERVICE

We guarantee to despatch by 1st class post or Securicor every order received by us up to 3.30pm that day, for goods available from stock. That means that, due to our commitment to massive in depth stocks, better than 95% of our product range is available to you within 24 hours. Every product we sell is supported by our technical enquiries department and datasheets are available on most products.

BBC MICROCOMPUTERS AND ACCESSORIES

BBC COMPUTERS

Model B	£346.95
Model B + Disc Interface	£441.95

BBC MICRO DISC DRIVES

BBC 31	Single 100K Drive Expandable to 2 x 100K	£229.00
BBC 32	Dual 100K Drives	£340.00
BBC 33	100K Upgrade for BBC 31	£122.00
BBC 34	Dual 400K Drives	£649.00

All disc drives (except BBC 33) complete with Manual, Utilities Disc, and Connecting Cables.

BBC UPGRADE KITS

BBCA2B	Complete A to B Upgrade	£44.75
BBC 1	16K Memory	£18.00
BBC 2	Printer/User 1/0KK	£ 7.50
BBC 3	Disc Interface Kit	£95.00
BBC 4	Analogue Input Kit	£ 6.70
BBC 5	Serial 1/0 Rab Kit	£ 7.30
BBC 6	Bus. Expansion Kit	£ 6.45

All kits are supplied with full fitting instructions.

Fitting Service available

BBC CONNECTORS

BBC 21	Printer Cable and Amphenol Plug (not assembled)	£13.00
BBC 22	User Port Connector and Cable 36"	£ 2.46
BBC 23	Cassette Lead	£ 3.50
BBC 24	7 Pin Din Plug	£ 0.60
BBC 25	6 Pin Din Plug	£ 0.60
BBC 26	5 Pin Din Plug	£ 0.60

BBC 35	Disc 1.0 Cable 34W IDC to 2 x 34 way Card Edge	£12.00
BBC 36	Disc Power Cable	£ 6.00
BBC 44	Analogue Input Plug & Lever	£ 2.25
BBC 66	1 M Bus Connector + 36" Cable	£ 3.50

BBC ACCESSORIES

BBC 45	Joysticks (per pair)	£11.30
BBC 67	Eprom Programmer (assembled)	£57.95

New Acorn Electron Ring for price and delivery

ACORNSOFT FOR THE BBC

SBE03	Business Games	£ 8.65
SBE04	Tree of Knowledge	£ 8.65
SBE02	Peeko Computer Inc Manual	£ 8.65
SBE01	Algebrail Manipulation PK.	£ 8.65
SBX01	Creative Graphics Cassette	£ 8.65
SBX02	Graphs & Charts Cassette	£ 8.65
SBB01	Desk Diary Inc Manual	£ 8.65
SBL02	Lisp Cassette	£14.65
SBL01	Forth Cassette	£14.65
SBG01	Philosophers Quest	£ 8.65
SBG07	Sphinx Adventure	£ 8.65
SBG03	Monsters	£ 8.65
SBG04	Snapper	£ 8.65
SBG15	Planetoid	£ 8.65
SBG06	Arcade Action	£10.35
SBG05	Rocket Raid	£ 8.65
SBG13	Meteors	£ 8.65
SBG14	Arcadians	£ 8.65
SBG10	Chess	£ 8.65

ACORNSOFT BOOKS FOR THE BBC MICRO

SBD01	Creative Graphics	£ 7.50
SBD02	Graphs - Charts	£ 7.50
SBD04	Lisp	£ 7.50
SBD03	Forth	£ 7.50

* Please ring for current delivery on Acornsoft products before ordering.

Fast ex-stock delivery on most items

BBC MICRO COMPONENTS

4516 100NS	£ 2.25
6522	£ 3.19
74LS244	£ 0.59
74LS245	£ 0.69
74LS163	£ 0.34
DS3691N	£ 4.50
DS88LS120N	£ 4.50
UPD7002	£ 4.50
8271	£36.00
20 Way Header	£ 1.46
26 Way Header	£ 1.76
34 Way Header	£ 2.06
40 Way Header	£ 2.32
15 Way D Skt	£ 2.15
6 Way Din Skt	£ 0.90
5 Way Din Skt	£ 0.90

BBC SOFTWARE IN ROM.

Wordprocessor "View"	£52.00
1.0 MOS	£36.00

Delivery Charges

Computers/Disc Drives	£5.00
Components/Software	£0.50
Books/Joysticks	£1.00

THE ABOVE LIST SHOWS JUST A FEW OF THE ITEMS IN STOCK. PLEASE TELEPHONE YOUR REQUIREMENTS – OR BETTER STILL SEND FOR OUR FREE CATALOGUE

Access
BARCLAYCARD

Carriage Orders up to £199 are sent by 1st class post, and £200 + by Securicor.
0-£100 0.50 £100-£199 1.25 £200 + 5.00 by Securicor.
Prices quoted (+ carriage charges) are exclusive of VAT and are subject to change without notice.
Quantity Discounts are available on many products, please ring for details.
Official Orders are welcome from Education Establishments, Government Bodies and Public Companies.
Credit Accounts are available to others subject to status. Payment is due strictly nett by the 15th of the month.
Credit Cards are accepted (Access and Visa) for telephone and postal order and NO SURCHARGE is made.
Out of stock items will follow automatically, at our discretion, or a refund will be given if requested.

Please complete this coupon for a copy of our FREE catalogue.

NAME ____________________

ADDRESS ____________________

____

____

TEL. NO. ____________________

Midwich
COMPUTER COMPANY LIMITED
1st
choice for microcomputer components
PRICE LIST

MIDWICH COMPUTER COMPANY LIMITED
RICKINGHALL HOUSE, RICKINGHALL, SUFFOLK IP22 1HH
TELEPHONE (0379) DISS 898751

From Page 28

background colour with any of the following line 25s:

25 COLOUR 129:CLS
25 COLOUR 130:CLS
25 COLOUR 131:CLS

What happens if you omit CLS?

```
 10 REM *** PROGRAM TWO ***
 20 MODE 5
 30 C%=0
 40 REPEAT
 50 C%=C%+1
 60 ASTERISK$=ASTERISK$+"*"
 70 COLOUR C% MOD 3 +1
 80 PRINT ASTERISK$
 90 UNTIL C%=18
```

Program II

As you can see, this prints out a triangle of asterisks, each line of which is in a different colour. This is achieved by line 70. C% MOD 3 gives the remainder when you divide C% by 3; these remainders can only be 0, 1 and 2 (you cannot have remainders of 3 or over when you are dividing by 3). This means that C% MOD 3+1 will return the values 1,2 and 3 since we are adding one to the remainder. The COLOUR statement of line 70 then uses these numbers to change the foreground colour.

As an exercise, see if you can alter the program so that it prints the colours of the lines out randomly. Use RND(3) – see the User Guide or Peter Davidson's article on page 60 for an explanation of RND( ). For more advanced, can you print out the triangle so that each asterisk within a line is randomly coloured? Finally, can you produce a red triangle, inside a yellow triangle, inside a white triangle of asterisks? These two problems require far more than a simple alteration of Program II.

```
 10 REM PROGRAM THREE
 15 MODE 5
 20 FOR I%=0 TO 19
 30 FOR J%=0 TO 30
 40 COLOUR RND(3)+128
 50 PRINT TAB(I%,J%)CHR$(32);
 60 NEXT J%
 70 NEXT I%
```

Program III

This prints out a nice tapestry, filling in each of the screen columns in turn, top to bottom, left to right. As a test, can you alter it so that it fills in each row in turn, left to right, top to bottom?

You might also like to try the following versions of line 40 – they're quite interesting. See if you can work out what is happening:

```
40 COLOUR (I%+J%) MOD 3 +129
40 COLOUR (I%*J%) MOD 3 +129
40 COLOUR (I%-J%) MOD 3 +130
40 COLOUR (2*I%+J%) MOD 3 +129
40 COLOUR (I%=J%) MOD 3 +129
```

So far, in a four colour mode we have had available the colours black, red, yellow and white. As we have seen, the computer doesn't refer to them by name but by the logical colour numbers 0, 1, 2 and 3. These numbers "label" the colours and we can, if we wish, change the colours that the logical colour numbers refer to. All we have to do is to use the VDU 19 command to tell the computer that we wish to assign a different colour to a particular logical colour number. This would be simplicity itself if the syntax were such that to assign blue to logical colour number 1 were

VDU 19,1,BLUE

Unfortunately, the computer refers to the colours available in its palette not by name but by number – each colour in the palette has assigned to it a fixed number, called the actual colour number *(see Figure III)*. The colour number for blue is 4. To tell the computer that henceforward logical colour number 1 is to be interpreted as actual colour 4 (blue) we use

VDU 19,1,4,0,0,0

Those trailing zeros are necessary for future expansion of the graphics system, we are told. Note the format:

VDU 19, logical colour reassigned, actual colour assigned, 0,0,0

So, to assign actual colour 2 to logical colour 2 in MODE 5 we would use

VDU 19,2,2,0,0,0

(Before we reassign logical colour 2 in mode 5 it is yellow i.e. actual colour 3. The command above tells the computer to interpret logical colour 2 as actual colour 2, i.e. green.)

Remember, logical colour numbers are variable in the sense that we can change the colours they "label". The number of logical colours available, however, is fixed by the mode and it is these logical colours that are referred to in such statements as COLOUR 1 or GCOLO,3 (more of which next month).

NUMBERS	ACTUAL COLOUR
0	black
1	red
2	green
3	yellow
4	blue
5	magenta
6	cyan
7	white
8	flashing black-white
9	flashing red-cyan
10	flashing green-magenta
11	flashing yellow-blue
12	flashing blue-yellow
13	flashing magenta-green
14	flashing cyan-red
15	flashing white-black

Figure III

Actual colour numbers are fixed, i.e. actual colour number 2 always refers to green. We use them in the VDU 19 command when assigning colours to a logical colour number.

If you find the trailing zeros a nuisance you can use the form

VDU 19,logical, actual;0;

e.g. the example above becomes VDU 19,2,2;0; Make sure you do not omit the final semi-colon – it can cause disaster!

One point to note is that when you reassign a logical colour to a new actual colour everything on the screen that is written in that logical colour (even if it was written before the reassignment) will instantly appear in the new colour. As we shall see, this will allow us to produce quite dramatic effects.

```
 10 REM PROGRAM FOUR
 20 MODE 5
 30 COLOUR 1
 40 PRINT TAB(2,12)"THIS MESSAGE"
 50 PRINT TAB(2,14)"DISPLAYS ALL THE"
 60 PRINT TAB(2,16)"ACTUAL COLOURS."
 70 PRINT TAB(2,18)"IT IS IN LOGICAL"
 80 PRINT TAB(2,20)"COLOUR ONE ."
 90 REPEAT
100 FOR I%=0 TO 15
110 VDU 19,1,I%,0,0,0
120 FOR J%=1 TO 9999:NEXT J%
130 NEXT I%
140 UNTIL FALSE
```

Program IV

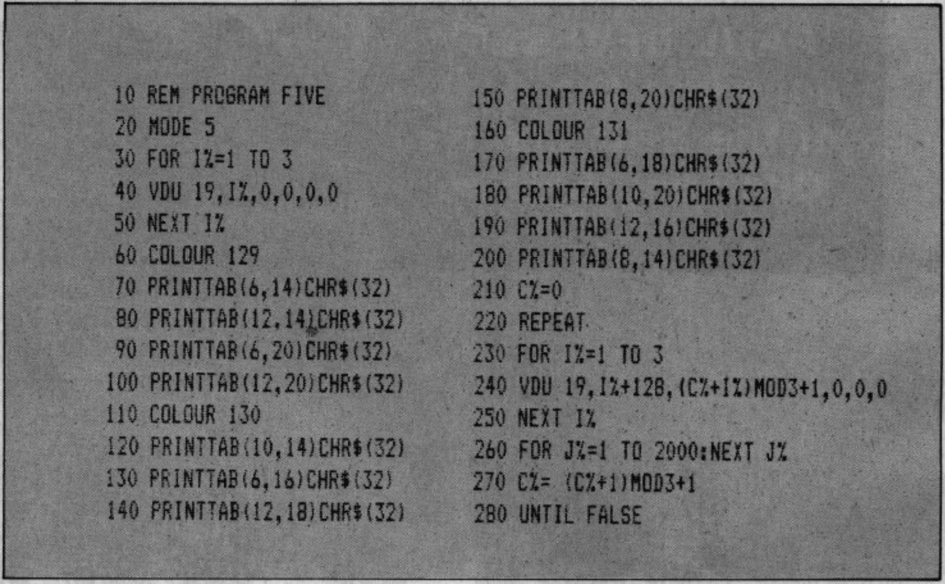
This shows the effects of writing a message in logical colour 1 and then using a loop to assign each of the actual colours in turn to logical colour 1.

Program V

This is more complex. Lines 30-50 assign actual colour 0 (black) to logical colours 1, 2 and 3. This ensures that anything that is written in any logical colour cannot be distinguished from the black background. This is a technique often used to blank out screen pictures that take a long and rather untidy time to build up. Once built up invisibly they are instantly made visible by reassigning the logical colours to the actual colours of the picture.

Lines 60-200 print out a rectangle of blanks (CHR$(32)) in logical colours 1, 2 and 3 in order around the perimeter of the rectangle.

Lines 220-280 then make the colours visible by use of the VDU 19 command. Each time round the loop the actual colours are reassigned to a different logical colour number so that, for example, red appears in different places. This is done cyclically so that the colours appear to rotate around the rectangle.



```
 10 REM PROGRAM FIVE
 20 MODE 5
 30 FOR I%=1 TO 3
 40 VDU 19,I%,0,0,0,0
 50 NEXT I%
 60 COLOUR 129
 70 PRINTTAB(6,14)CHR$(32)
 80 PRINTTAB(12.14)CHR$(32)
 90 PRINTTAB(6,20)CHR$(32)
100 PRINTTAB(12,20)CHR$(32)
110 COLOUR 130
120 PRINTTAB(10,14)CHR$(32)
130 PRINTTAB(6,16)CHR$(32)
140 PRINTTAB(12,18)CHR$(32)
150 PRINTTAB(8,20)CHR$(32)
160 COLOUR 131
170 PRINTTAB(6,18)CHR$(32)
180 PRINTTAB(10,20)CHR$(32)
190 PRINTTAB(12,16)CHR$(32)
200 PRINTTAB(8,14)CHR$(32)
210 C%=0
220 REPEAT
230 FOR I%=1 TO 3
240 VDU 19,I%+128,(C%+I%)MOD3+1,0,0,0
250 NEXT I%
260 FOR J%=1 TO 2000:NEXT J%
270 C%= (C%+1)MOD3+1
280 UNTIL FALSE
```

Don't worry too much if you don't as yet fully understand how this rather primitive animation works – we will be covering this area more fully in future articles.

Well that's all for this month – if you want to test your command of the VDU 19 command try to arrange it so that the four colours used in MODE 5 are green, cyan, magenta and blue.

MYSTERIOUS ADVENTURES

Join the growing band of Adventurers who are enjoying these absorbing and stimulating programs. Step into another world of Fantasy, Magic, Mystery and Sorcery. Only your wits and cunning can ensure success in these scenarios!

FOR BBC MICROCOMPUTER MODELS A & B*

- WRITTEN IN ULTRA-FAST MACHINE CODE.
- SAVE GAME FEATURE.
- SPLIT SCREEN DISPLAY.

1. THE GOLDEN BATON – Venture into a strange province of Sorcery and Evil Magic to recover the Golden Baton, a priceless artifact whose powers are said to bring great Health and Prosperity to the Land.
2. THE TIME MACHINE – As a Newspaper reporter you are sent to investigate the eccentric professor who lives in the old house on the Moors. What is his secret and why is his house now deserted?
3. ARROW OF DEATH (Pt. 1) – A blight has fallen on your homelands, the Baton has become tarnished and now radiates a malevolent aura of Evil. Your mission is clear – trace the source of this Evil and destroy . . . or be destroyed. This is the first part of an Epic Adventure although each part can be played as a stand alone scenario.
4. ARROW OF DEATH (Pt. 2) – You now have the means to destroy your enemy . . . but you are far from home and this land is strange to you. Can you cope with the deadly perils which approach you and have you the strength to see your mission through to the final conflict?
5. ESCAPE FROM PULSAR 7 – Alone on a gigantic Space-Freighter. The rest of your crew have died horribly at the hands of a mutated Zoo-Specimen. Your only chance of escape is to reach the Frail Shuttlecraft. But the lurking Monster is hungry and you are the only food it has left . . .
6. CIRCUS – Your car has run out of petrol on a lonely road miles from habitation. As you trudge reluctantly down the road in search of help you are suddenly confronted by an amazing sight . . . in a nearby field is a Huge Circus tent! But this is no ordinary Circus as you will soon discover . . .
7. FEASIBILITY EXPERIMENT – Far across the gults of time and space, a dying race of super intelligent beings search the Universe for a Hero to save their existence . . . at length their thoughts turn to plant Earth. You are chosen to be their saviour in a bizarre scenario where death is a mere thought away . . .

* Adventures 5, 6 and 7 require 32K RAM.

EACH ADVENTURE COMES ATTRACTIVELY PACKAGED FOR JUST £8.95 + VAT

SEND CHEQUE OR P.O. TO
DIGITAL FANTASIA DEPT. B.B.N.
24 NORBRECK ROAD, NORBRECK, BLACKPOOL, LANCASHIRE.
Tel: (0253) 56279

PAUL BEVERLEY goes into the ABCs of the BBC Micro's Operating System.

THERE has been quite a lot of correspondence recently in various magazines about what is called the "operating system" of the BBC microcomputer. There is discussion about which version is currently available – "0.1" or "1.0" or "1.2" – whether it is in ROM or in EPROM, how you can get hold of the new operating system, and so on.

To the beginner, this is all rather confusing, so in this article I shall assume that you don't know what an operating system is, what it does or why you need it or even what ROMs and EPROMs are.

I shall try to explain from first principles what it is all about, and try to give a little bit of explanation, in simple terms, about how the BBC microcomputer actually works.

Then I'll look at the basic differences between the different versions of the operating system, when and why you might need a later version and how you go about getting hold of one.

Next month I will go into a bit more detail about how the operating system works and why it is important to use it rather than taking short cuts.

Let's get down to those basic

AT the heart of the BBC microcomputer is a microprocessor chip – a 6502 actually, but that doesn't really tell you anything if you are a beginner! This chip is like a smaller version of the central processor of a mainframe computer and it takes its instructions in what is called machine code, that is, the instructions take the form of bit binary numbers.

The basic function of this microprocessor is to manipulate and transfer data within the microcomputer. This data, like the instructions themselves, takes the form of 8 bit binary numbers or bytes as we usually call them.

Both the data and the instructions are stored in numbered locations within the computer, and which of these locations the processor is talking to is determined by a 16 bit binary number which we call the address.

This means that the computer can have up to 2 16 memory locations, which is 65,536. To abbreviate this we use the fact that 65,536 = 64 x 1024, and that 1024, since it is approximately a thousand, is known in computer jargon as 1k. So we say that the 6502 microprocessor can address 64k memory locations.

Some of these numbered cells contain fixed information which the processor uses but is unable to change. This is called read only memory, or ROM for short, and contains the machine code programs which determine the way the system as a whole operates.

Then there are other memory locations which the processor can not only read, but also alter. This is sometimes called read-write memory or more commonly random access memory (RAM) and is used to store the user's programs and any transient data which the user or the processor itself needs. In the model B there is 32k of RAM and 32k of ROM, making up the full 64k.

So what is an EPROM?

An EPROM is rather like a ROM in that the computer can only read and not alter the data in it. The difference is that a ROM has the data put in it during manufacture and is completely unalterable, whereas an erasable programmable read only memory, to give it its full title, has its data put into it electrically by using large voltages (well, large compared with the five volts needed to operate it normally) to "blow" the data into it.

Also, as the name suggests, it is possible to erase the data and reprogramme it. The erasure is done by exposing the chip to ultra-violet radiation. This wipes the memory clean and the chip is then ready to be re-programmed.

The other differenc between ROMs and EPROMs is the cost. The technique o making ROMs is a fairly standard semiconducto manufacturing process, and s provided they are being made in large enough quantities they are fairly cheap.

An EPROM, on the othe hand, uses a more complex manufacturing process, s although they are not confined to one dedicated application they are relatively expensive It will be worth remembering this fact when we come t consider Acorn's policy o replacement of old operating systems.

Programming the processor

As you can probably imagine, it would be difficult to programme the processo directly in machine code – i would be so easy to get a few

---

Paul Beverley is lecturer in electronics at Norwich City College.

Routine	Summary of function
OSFIND	Open or close a file
OSGBPB	Load or save a block of memory to file
OSBPUT	Save a single byte to file from accumulator
OSBGET	Load a single byte to accumulator from file
OSARGS	Load or save data about a file
OSFILE	Load or save a complete file
OSRDCH	Read a character (from keyboard) to accumulator
OSASCI	Write a character (to screen and/or RS423), plus LF if character = &0D
OSNEWL	Write an LF, CR (to screen and/or RS423)
OSWRCH	Write character (to screen and/or RS423)
OSWORD	Perform miscellaneous OS operations using control block to pass parameters
OSBYTE	Perform miscellaneous OS operations using registers to pass parameters
OSCLI	Intepret the command line given

Table 1: Summary of basic operating system commands

building blocks

1s and 0s mixed up which would stop your program working properly.

Even when using the hexadecimal numbering system, which basically uses a single character to represent each 4 bit binary number, it is still an extremely difficult and arduous task.

One step up from this is a system known as an assembler which is itself a machine code program stored in ROM which allows you to enter the instructions you want the processor to act on in the form of mnemonic codes such as LDA, STA, INX, TYA etc.

The assembler then converts these codes into a machine code program and runs it for you. Although still almost totally incomprehensible to the outsider, they are in fact not all that difficult to learn and are certainly easier to interpret than the original machine codes.

The next stage up the ladder is to provide a system which allows you to enter instructions in a language which bears some resemblance to everyday language – words like FOR, NEXT, PRINT etc.

The high level languages

Such a system is known as a high level language because it allows you to use single words to manipulate numbers consisting of four or five bytes at a time and to generate functions like SIN, COS, LOG etc without delving into all the shunting and manipulating of bytes that is needed to do any one of these jobs.

The routines which are within the Basic ROM on the BBC machine, apart from providing the assembler facility, allow you firstly to enter and edit your Basic program from the keyboard, secondly to save and load complete programs from a filing system such as tape or disc, and thirdly to actually execute or "interpret" the programs.

The Basic interpreter is a program, written in machine code of course, which examines each of the Basic program lines in turn and acts on it appropriately. This accounts for the relative slowness of Basic, since what is happening is that one machine code program is scanning some text stored within the computer (the Basic program) and then acting on that.

Also when, as is usually the case, a particular line of the program is executed repeatedly, Basic has to read and interpret the line every single time it comes to it before acting on it.

There is one way of improving on the speed of interpreted Basic without going into machine code, and that is to use what is called a compiler, although this is not a facility available for the BBC microcomputer as yet.

When you have written your Basic program the compiler looks through the whole of it and turns it into a sort of machine code version of the original Basic instructions. This code can then be executed directly, and although it is still not as fast as a true machine code program, at least it does not have to waste time while the program is running having to interpret each line before it can be executed.

Basic routines are a "must"

Whichever language you are using, whether actual machine code, assembly language, a high level language like Basic or Pascal, or even a word processing system, you need certain basic routines to handle the system as a whole.

These basic routines there-

→

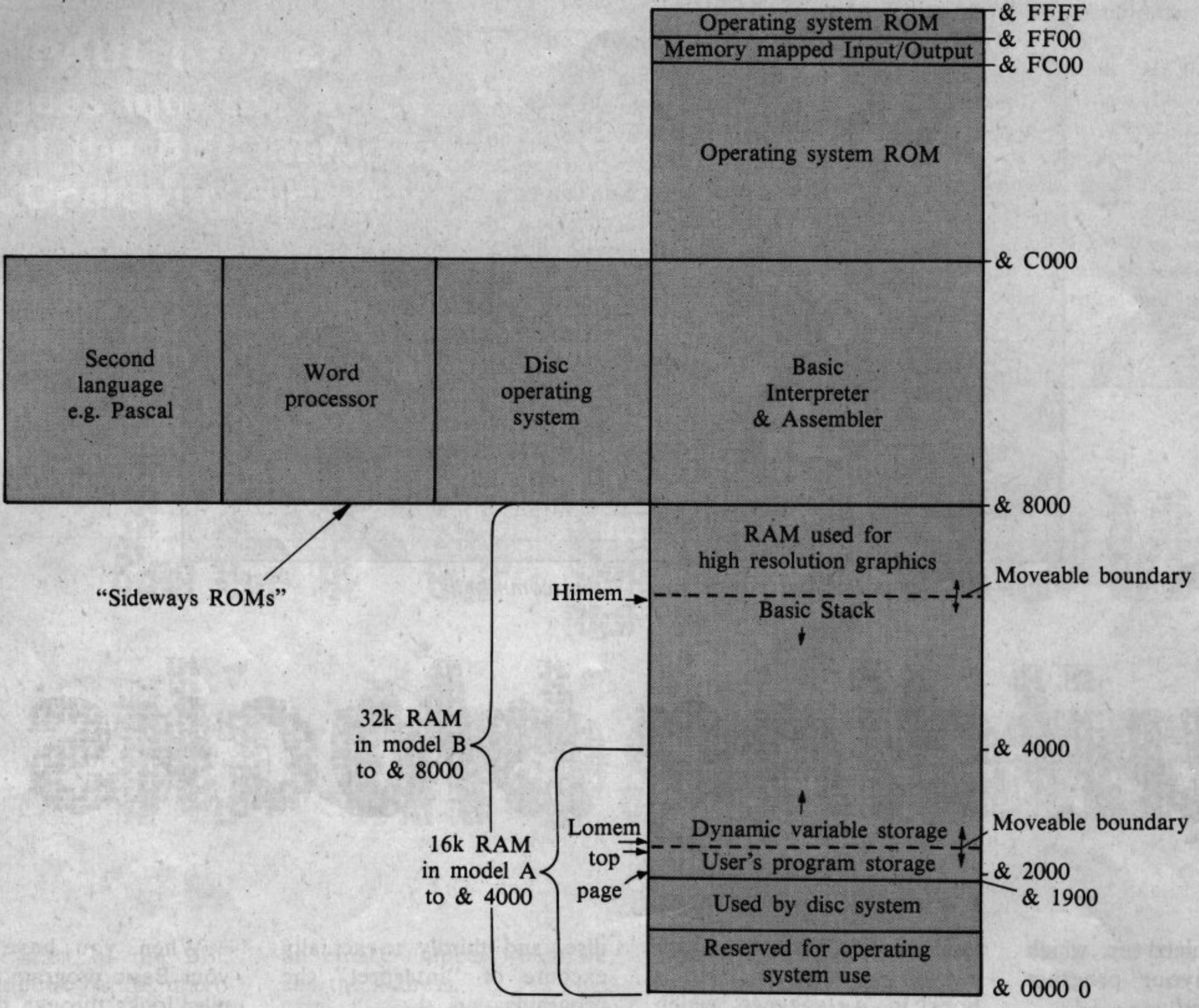

Operating system ROM
Memory mapped Input/Output
Operating system ROM
Second language e.g. Pascal
Word processor
Disc operating system
Basic Interpreter & Assembler
RAM used for high resolution graphics
Basic Stack
Dynamic variable storage
User's program storage
Used by disc system
Reserved for operating system use
& FFFF
& FF00
& FC00
& C000
& 8000
Moveable boundary
& 4000
Moveable boundary
& 2000
& 1900
& 0000 0
"Sideways ROMs"
Himem
Lomem
top
page
32k RAM in model B to & 8000
16k RAM in model A to & 4000

Figure 1: The basic memory map showing possible usage of the sideways ROMs

From Page 33

fore need to be available to whichever language is being used. So they are all put into one area of memory and called the operating system.

They include all the routines for drawing and writing on the screen, loading and saving data and programs, plus a whole library of routines for handling input/output such as sound, 1 mHz bus, printers, RS423 serial interface etc. A brief summary is given in Table 1.

By what I have just said about using different languages, I have implied that you can use your BBC microcomputer for languages other than Basic, and in fact there are five 16k ROM sockets on the main printed circuit board of the computer which makes 80k of ROM storage in all.

If you add the 32k of RAM, this appears to contradict what I said about an 8 bit processor only being able to address 64k of memory. But what Acorn have done is to set aside four of the sockets for "sideways ROMs". This is illustrated in the memory map – Figure 1.

The idea is that the operating system ROM is permanently available, but at any given time only one of the other four ROMs is actually selected while the other three are disabled.

This is sometimes referred to as "paging", i.e. you can only read one page at a time, but then you can switch to another one and read that one, and since this switching only takes a matter of a few microseconds, the user is usually totally unaware of it.

So if you have the Basic chip and the operating system occupying two of the sockets, that leaves three spare sockets into which you can put other ROMs. But if you have a disc system you will find that one of these sockets is already filled by the disc operating system software.

So as I have said, these ROMs could contain other language interpreters or word processing facilities so that you could say *PASCAL, *LISP or *WORDWISE etc to switch from language to language. But alternatively they could contain extra commands such as graphics routines. These extra commands could then be called from any language by names such as *SPLINE or *FILL or *DISASSEMBLE.

Finally, they could contain actual applications programs in whichever language you have an interpreter for. You type in *ROM and then LOAD "FRED", or whatever the program is called, and the operating system searches through all the available ROMs to see if it has got a program of that name, and if so, loads it into RAM. (This facility is only available after release 1.0.)

I understand that Acorn Computers are working on a

→

Two top quality programs from Kansas – for four years the Brand Leader in microcomputer software . . .

Don't struggle with your keyboard, make it easy with

MICROTYPE

The ultimate typing tutor – now upgraded for the BBC

Recognised as the standard in typing tutors since it was introduced to microcomputers some three years ago, the Kansas Microtype has been still further improved and converted to the BBC Micro.

So you have a Beeb! Which means you, and most likely those around you are going to spend a fair bit of time in the future at the keyboard. Not just in the near future, but for many years to come, as computers are here to stay.

So why not master the keyboard now? Stop chugging away with just a few fingers and your eyes for ever on the keys – learn to touch type, giving you speed and accuracy.

Microtype will allow you to teach yourself, and will progress as you improve. Just a few short sessions and you will see results. Keep at it for say half a hour a day and you will be touch typing within a week, with no need to look at the keys ever again! Keep at it and speed will follow.

Apart from simple working instructions and a finger position chart, everything is actually shown on the screen. You don't have to wade through a printed course. You will be prompted the characters to type on the screen and will be shown which are being keyed in correctly and which are not.

At the start you will be given the 'home' keys to practice, but unlike normal typing tutors, the computer can tell on which keys you are inaccurate or slow and so can give more practice on these keys whilst at the same time replacing those on which you are proficient.

There is also the choice of practice mode or paragraph mode. So once the program has given, and you have learned, most of the keys, paragraphs can be attempted.

There are ten short exercises in each lesson, with a complete analysis of your performance at the end. This includes your average typing speed, accuracy and any keys you mis-keyed. If a response time is set, the program will also show the keys on which this time was exceeded. Being designed for micro keying, a great many of the words selected by the program are those which are actually used in programming the BBC. But of course, it is also ideal as a normal typing tutor, as both typewriter and computer keyboards are the same.

VAT and post paid – £12.50

A real traditional Adventure for the BBC. . .

DRACULA ISLAND

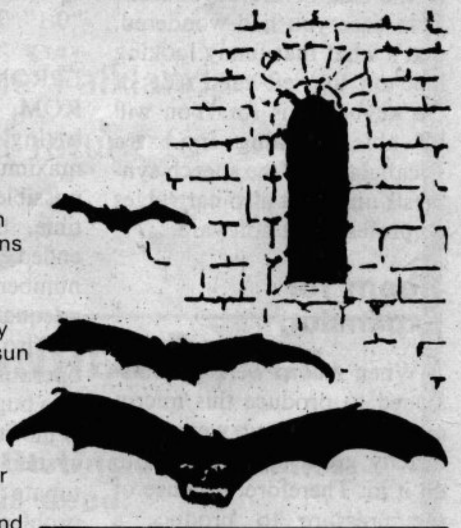
Ever played a good adventure game on a Micro? If not, you are in for endless hours of enjoyment, with no little hair tearing in the bargain in the attempt to solve it. A traditional adventure always has a purpose and is absolutely logical in that the locations are always in the same place, objects are either in their place or where you leave them, and the conditions depend exactly on the action you take.

Using directions and two letter words, you set off on your adventure, in this case to kill Count Dracula! But beware, there are many pitfalls awaiting you on your journey and many objects will have to be found, always bearing in mind what happens to Dracula when the sun goes down. But it all adds up to days and days of fun – and frustration!

Being written for the BBC, use is made of the micro's colours during operation, not just because they are there, but to actually help in playing the game.

The programmer says it will take on average three weeks to solve. But there is a bonus, for unlike the adventures already available for the BBC, your progress with Dracula Island can actually be saved to tape. This means that after making progress, you can save the data, and then load it back at a later time to carry on playing from the actual place at which you last finished, and as many times as you want.

If you have played adventures on other micros, you will find this one exceptional, and if you have never played an adventure before, it will get you hooked – try it . . .



HELP! If you get absolutely stuck with Dracula Island, give our adventure expert, Jan Green, a ring – she'll help!

VAT and post paid – £9.50

If you have never purchased a program from Kansas before, you are in for a pleasant surprise!

We have been in the software business ever since it first started, and so have the experience and expertise to produce the very best programs, unlike the many new firms which have to reply on new programmers offering their wares. Little wonder the software buyers for the BBC have become so disillusioned at the amateur programs currently being offered. But not only the programs, the complete lack of packaging and presentation leaves a great deal to be desired.

And the length of time you have to wait! How different at Kansas, for we boast the fastest software service in the country. Every single order is completed and despatched the very same day it is received – whether payment is by cheque or credit card. We have even gone to the expense of a private Post Office collection at 4.30 every working day to speed the delivery. In fact, if you order by credit card over the 'Phone by 4pm you will get the software tomorrow!

Now is the time to bring some professionalism to the BBC scene, and who better than Kansas, recognised for the past four years as Brand Leader in microcomputer software. . .

SEE US AT THE SHOWS

PCW Show Edinburgh
16-18 April

Midland Computer Fair Birmingham
28-30 April

Computer Fair Earls Court
16-19 June

GUARANTEE

Every program is guaranteed for life! Which means, if it fails, no matter how caused, it will be replaced absolutely free of charge – this year, next year or in ten years!

SORRY – NO DEALERS
In view of our guarantee and return post service Kansas programs can only be purchased direct.

Kansas

Publishers of the famed Kansas 'Arcade' series – now available for the BBC Micro

Kansas City Systems, Unit 3, Sutton Springs Wood, Chesterfield, S44 5XF. Tel. 0246 850357

From Page 34

printed circuit board which can be put inside the main box of the computer which will allow you to put up to 16 sideways ROMs on it. That makes a total of 256k bytes of ROM, not including the operating system ROM, which should be enough for most applications. But if you want even more you can add cartridge ROMs on the socket at the side of the keyboard.

In case you had wondered, that's what that funny looking hole on the left-hand side of the keyboard is for. You will be able to plug in extra vocabulary for the speech synthesis unit, and also cartridges of professional software.

Room for expansion

When Acorn were commissioned to produce this microcomputer, they were not exactly given a lot of time to do it in. Therefore, because of the pressure to produce a working system within a given time limit, they did it in such a way that they could expand and improve the operating system software at a later date.

The problem was not to produce a working version of Basic, since they had a good version already running on their other systems. All they had to do was tailor it to this particular machine and add the extra facilities for BBC Basic.

The real problem was to produce the vast number of routines needed for the complete operating system, and it was important to ensure that facility was made for expansion of the system at a later stage.

In particular, it was important to make it possible to add a second processor on the high speed data link known as the "Tube", which, as I have always maintained, is about the single most important feature of the BBC microcomputer since it allows unlimited expansion of the system so that you can keep pace with technological developments.

Knowing that it was not possible to keep all of the people happy all of the time, Acorn produced a provisional version of the operating system which was known as "0.1". This was sent out in the very first machines in EPROM, and then later in ROM. In theory they were trying to implement the maximum number of features possible within the available time, but it seems to have ended up as the minimum number necessary to get an adequate working system.

Also, in practice the 0.1 operating system has one or two bugs in it, which I suppose is inevitable in such a complex system, but it is just unfortunate that one of the main problems is with the cassette system. You may well have seen in various magazines a number of possible solutions to the problem.

The 1.0 operating system then is the up-dated version with the known bugs removed and all the features put into it that were promised in the original specification (and more besides!).

The theory is that whenever you really *need* the 1.0 operating system, it will be provided to you free of charge. For example, if you want to have a disc interface added to your machine then you will need the 1.0 system and it will be fitted at no extra cost. Mind you, it is worth noting that the amount which dealers charge for doing the disc upgrade varies enormously.

You will also find that some of the word processing systems will need the 1.0 system, certainly the more professional ones like Computer Concepts' Wordwise.

But Computer Concepts have said that when you buy the Wordwise chip they will sell you the new operating system for a nominal fee which they say will definitely not be more than £7.50. Certainly you will need an updated operating system if you want to add a second processor to your machine, but in fact even the 1.0 will not do – it has to be version 1.2.

There were a few minor bugs in the 1.0 system when it came to communicating with a second processor. But again, the new operating system should be fitted free of charge when you get your second processor.

Where the 1.0 comes in

If you start doing much programming in assembly language other than doing one or two small routines to add into Basic programs, you will find yourself wanting to use the operating system calls which are "only available from release 1.0", as the User Guide puts it.

In which case, if you are lucky enough to have the 0.1 system in EPROM, then when the 1.2 ROMs become available, Acorn say they will replace them free of charge. This is because the old EPROMs are re-usable, whereas the old 0.1 ROMs are useless since they cannot be re-programmed.

But if you have the 0.1 ROM then the official Acorn policy at the time of writing is that it will cost you £10 plus VAT to get it replaced, and it will be replaced by the 1.2, as this is the version that has been sent to the semiconductor manufacturers for turning into a ROM.

To find out which version you have got, the theory is that you type *FX0, but unfortunately in their haste to get the 0.1 system into ROM, Acorn forgot to change the message at the beginning of it, so a 0.1 ROM will proudly tell you that it is a 0.1 EPROM.

Therefore to find out which one you really have got, you will have to take the top off your microcomputer and look inside at the integrated circuit sockets just under the top right hand corner of the keyboard.

If all the sockets are filled then you're in luck – you've got EPROMs, but if only two of the five sockets are filled then you've got the ROM version.

I hope that you feel that you now understand a bit more about the background to all the fuss that is being made at the moment about the operating system.

I have deliberately reserved my comments to those of a technical nature and have avoided making any judgements about the rights and wrongs of producing a computer which some would say does not meet the specification under which it was sold and under which it is still being quite extensively advertised (using comments from one of my earlier articles to support their claims!).

However, I still believe that with the 1.2 operating system, the BBC Micro is a superb machine with tremendous potential for future expansion and I shall certainly continue to use it and write about it for the forseeable future.

NEXT MONTH: *Some more technical details about how the operating system actually works and why it is important to use the routines that are provided rather than taking short cuts.*

FINANCIAL GAMES
BBC Model B

THE WORLD TRAVEL GAME

1 or 2 Players,
Choice of Game,
'Exciting, Tense, Competitive and even Educational'

★ ★ ★ ★ ★

Travel the World; Journey by air, rail and road.
Exchange currencies; Buy souvenirs; Book tickets.
Cope with hijacks, strikes, robbery and other problems inherent with travel.

Visit countries as diverse as Russia & the Falklands.

Your aim is to collect 6 souvenirs and return to LONDON intact!

– £6.95 –

GREAT BRITAIN LTD.

You are P.M. and Chancellor of 'Great Britain'

You must select the Party you wish to represent and your aim is to stay in office for as long as possible. You must control inflation and unemployment, maintain the exchange rate, introduce social reforms and stay popular. The game is split into sectors: country profile, shopping basket, budget day, reform opportunities, manifesto, and most important election nights (a telling time).

A COMPLEX GAME THAT YOU WILL NOT TIRE OF IN A HURRY

– £5.95 –

INHERITANCE

Gt. Uncle Arburthnot is dead.
You stand to inherit!!

A 2 part game. Prove your financial accumen in Part 1 by investing wisely at the stock and metal markets; if desperate try the casino or the horse races. If you are successful you will enter the world of big business in Part 2. Find the secret formula for paradise cola; manufacture and market the drink; cope with strikes, fires, frauds, cash shortages, etc. Your ultimate aim is to become a millionaire! **A MAMMOTH GAME PACKED FULL OF FEATURES**

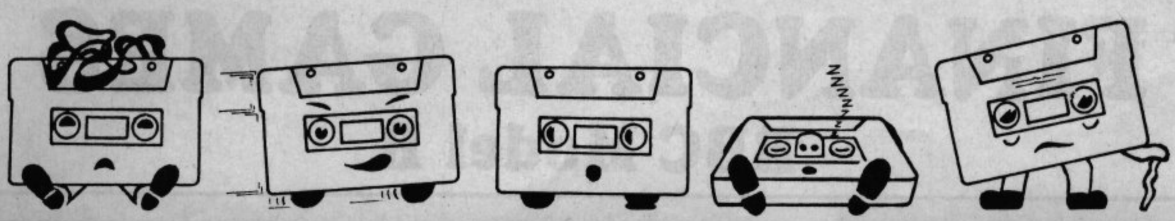
– £5.95 –

See Reviews in:
Acorn User Dec '82 – Personal Computer Jan '83

Trade Enquiries Welcome. Special Deals for Schools.

Simon W. Hessel (Dept B)
15 Lytham Court, Cardwell Crescent, Sunninghill, Berks.
Telephone: Ascot 25179

24HR DESPATCH – ONE YEAR GUARANTEE – MONEY-BACK IF NOT SATISFIED



Cut out those cassette capers

Make your interface wear a smile, with *Mike Cook's* aid

PERHAPS the most maligned aspect of the BBC Micro, and for that matter most other computers, is that of the cassette interface. This is odd because the BBC computer has one of the best cassette systems available for use on an ordinary domestic audio cassette recorder.

At this point I will pause while some readers recover from a fit of hysterical laughter.

Most of the problems encountered in loading and saving programs lie in the recorder. "If God had meant audio cassette recorders to store data he would have given them greater bandwidth!"

However, that notwithstanding, what are the problems that perplex so many and how can they be cured?

● Saving and loading from your own machine.

If this is the trouble type in a short program and save it to tape. Then play it back with no leads connected to the recorder so that you can hear the result.

The sound should be clear and crisp, with no hum, clicks or background noise. If it is not, then suspect the connecting lead. Is it giving too much or too little signal to the recorder?

Has your recorder got a built in microphone? If so then does it cut out when your computer is plugged in? Test this by whistling into it when recording your short program. Assuming this is OK, turn your computer off and on to make sure the program has gone, and try to load it in. If nothing happens then the volume reaching the computer is wrong.

Yes, I know you have spent hours fiddling with the thing, but that is not all there is to it. Try with the tone control at the extreme of its setting and then try again with it at the other extreme. All the tape recorders I have come across need the tone control at one extreme or the other.

Is enough volume getting into the computer? Some recorders I have used have a separate socket for an external loudspeaker and a multi pin DIN socket. Some leads use only the DIN socket and on some recorders this does not produce enough signal to drive the computer.

You need about 2 volts peak to peak as measured on pin 3 of the cassette DIN socket in the computer. Take the lid off and have a quick look with an oscilloscope to confirm this.

Finally is your tape dropping apart or was it a bargain buy? A small piece of oxide missing from the tape can cause dropouts which will be difficult to hear but will mean missing information to the computer.

● You can save and record programs from your own machine but cannot read some or all of the programs recorded by someone else.

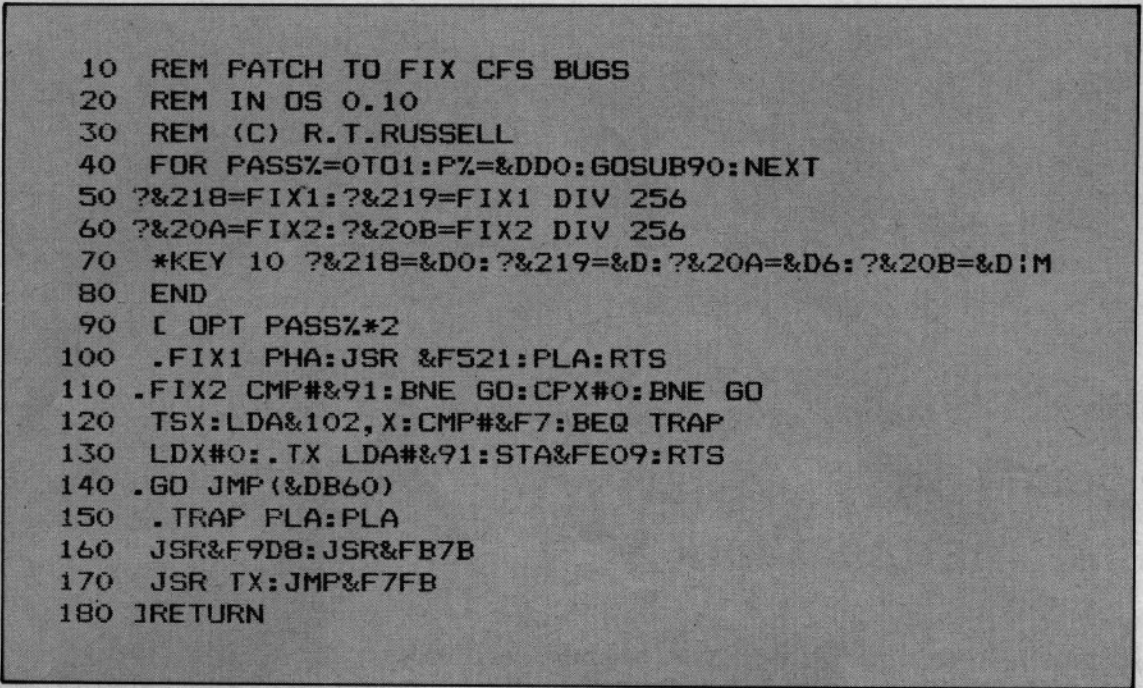
This is a very common problem with cassette recorders and is caused by misalignment of the recording head.

The area used to record information is determined by the physical position of the recording head. As it is also used to play back recordings, any made on your own machine will not be affected by misalignment.

However when you take a tape that has been produced on another machine the full width of the recorded track is not picked up on replay. This results in loss of bandwidth and corruption of signals.

You can test for this by playing back a pre-recorded computer program and listening to it. Does it sound as sharp and crisp as your own programs or does it sound slightly "muddy"? If it is, then you might rectify matters by altering the tone and volume controls, but the odds are that you won't. What you need to do is to alter the head alignment.

This can be achieved by locating a small screw near the recording head and adjusting



```
 10  REM PATCH TO FIX CFS BUGS
 20  REM IN OS 0.10
 30  REM (C) R.T.RUSSELL
 40  FOR PASS%=0TO1:P%=&DD0:GOSUB90:NEXT
 50 ?&218=FIX1:?&219=FIX1 DIV 256
 60 ?&20A=FIX2:?&20B=FIX2 DIV 256
 70  *KEY 10 ?&218=&D0:?&219=&D:?&20A=&D6:?&20B=&D|M
 80  END
 90  [ OPT PASS%*2
100  .FIX1 PHA:JSR &F521:PLA:RTS
110 .FIX2 CMP#&91:BNE GO:CPX#0:BNE GO
120  TSX:LDA&102,X:CMP#&F7:BEQ TRAP
130  LDX#0:.TX LDA#&91:STA&FE09:RTS
140 .GO JMP(&DB60)
150  .TRAP PLA:PLA
160  JSR&F9D8:JSR&FB7B
170  JSR TX:JMP&F7FB
180 ]RETURN
```

Cassette bugs fix for operating system 0.1

it until the pre-recorded tape sounds crisp and clear. Snag is, of course, that all the programs you have previously recorded will now sound muddy and will not load!

The only difficulty with head alignment is finding the screw to adjust. It is probable that you will have to drill a small hole in the recorder case to access this.

If you do, then find the position of the screw when in the record/play mode because it is attached to the record head and moves with it. You want to be able to adjust this when the recorder is playing so that you can hear the results.

If you are in doubt consult a dealer.

● **Things go wrong when using data files, or the occasional program refuses to load.**

This is a software bug in the computer's operating system (version 0.1) and can be cured by running the program printed above whenever the computer is powered up.

Key 10 is programmed so that pressing BREAK once will not disable the patch. Our thanks to Mr R.T. Russell for permission to publish this fix.

● **The cassette relay has burnt out.**

If it has burnt out leaving the recorder permanently running then you have probably welded the connections together. They might be freed by prising the top of the relay cover (it's plastic, so you might have to break it off) and see if you can prise apart the contacts. If you can it should work perfectly again.

The relay used is a heavy duty one, so why did it become stuck? This happens if you pass more current through the relay than it can take. There should be no problem in stopping and starting a recorder, as this takes very little current. However when rewinding tapes the motors take more current and there is a surge at the start and when the tape comes to an end and will not wind further. This could well exceed the relay's rating. The solution is always to unplug the recorder from the computer when fast winding tape.

● **Programs are lost that you recorded some time ago.**

This can be due to a dirty tape head – and there are many head cleaning kits on the market. You could also try a head demagnetiser if you start getting trouble after about a year of use. Most probably though, the cause lies in the storage of tapes.

Do not leave them near a magnetic field, which could be produced by many things, the most common being loudspeakers and electric motors.

Do not handle tapes with dirty hands or smoke while handling them as this can physically damage the tape and the head. Finally always keep them in their plastic boxes when not in use.

● **It works sometimes, but not others.**

Check all the above and if these are OK you might have an interference problem. This can be caused by many things but in a domestic environment it is usually something with a thermostat.

Central heating systems and refrigerators are frequently the culprits. They can cause a "spike" on the mains and radiate interference, the resultant click throwing your computer.

If the click occurred while recording it is on the tape and nothing can be done. The cure is to suppress the offending device. If in doubt call in an electrician.

Sewing machines and light dimmers can also cause this problem and they might not be in your house but your neighbour's, in which case diplomacy is indicated.

If all fails you can try fitting a mains filter to the plugs on your equipment. They can be quite expensive and will not cure radiated interference, so try to find out if one will cure your problem by getting one on loan before buying it.

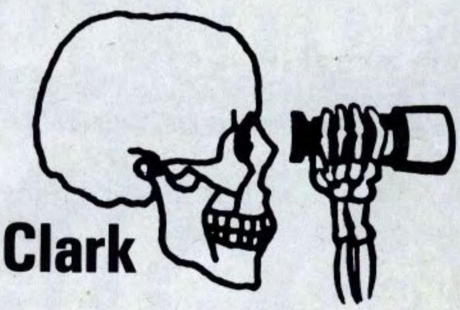
● **You've tried all that and it's still no good.**

I give up! Ship the lot, computer, cassette recorder and lead, back to the dealer.

Mains-borne spikes can throw programs

DEATHWA

Play this brilliant arcade game by Brian and Marian Clark



IN this program, which is for Model B only, you are in command of a field gun dug into a hillside fortress. There are many tanks on the plain below you, and on the shore more are being disembarked from the landing craft. Helicopter gunships appear from time to time to support the tanks.

When a tank has its sights lined up on you it will fire once. They never miss, but the damage caused is variable. The ships are unarmed, but they are in range and score highly, as do the helicopter gunships. These do not always fire at you, but when they do they also never miss.

If you survive the first attack you are given a short breather for repairs – up to 33 per cent of the damage – before battle recommences. A good high score is around 6000. Full instructions and a high score table are included in the program.

For those who cannot resist tinkering with their programs, the following points may be of use:

- Targets all appear black on the screen but use of the VDU19 command allows them to be assigned different logical colours. This facilitates scoring:-

	Colour	*Score if hit*
Large tanks	1	10x1
Advancing tanks	2	10x2
Small tanks	3	10x3
Airplane/ship	13	10x13

This illustrates that it is not necessary to know the position of the target or its type in order to score when a hit occurs.

- A further use of the VDU19 command protects the headings. The sky is in fact divided into two colour numbers (both light blue) and when the shell reaches the edge of the first it recognises the boundary of play. This prevents the score from exploding.
- The colour on the screen is identified by using the POINT command from Basic. However it was discovered in the 0.1 ROM the position of the point must first be set with the MOVE statement.
- The code to move the gun barrel left-right was initially written in Basic to enable the logic to be evolved. However during testing it was felt that this slowed play. The routine was consequently converted into machine code, which improved the response considerably, but barrel movement still affects the speed of the shell.
- Fine tuning can be seen by the use of the routines PROCFR, PROCPT and PROCMV in the main procedure PROCPLAY.

PROCFR to fire or move a shell
PROCPT to print or fire a target
PROCMV to move the barrel (machine code)

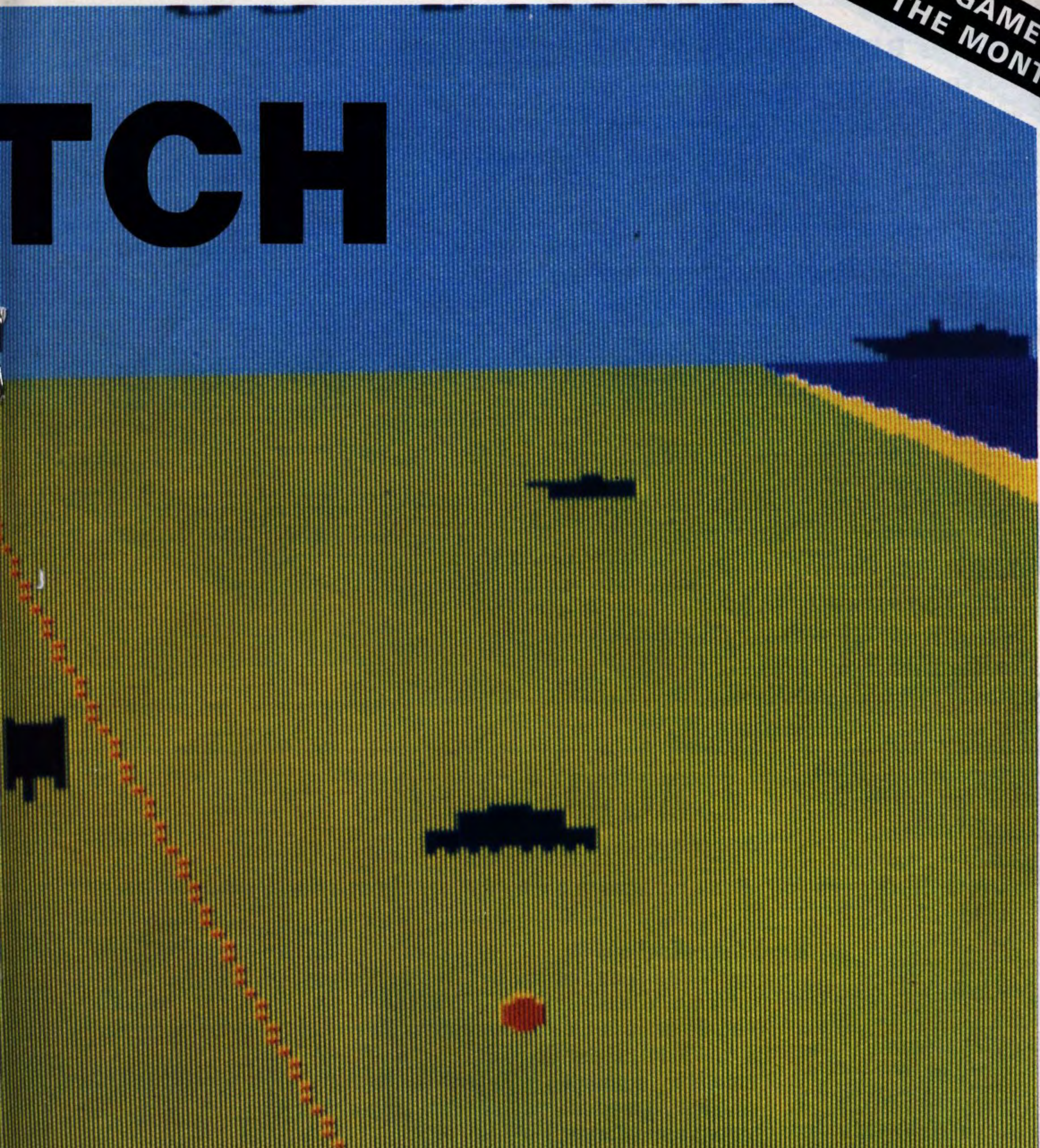
The frequency and sequence of these routines is the key to the flow of motion in the program. It is an interesting experiment to alter these and observe the different effects. The character of the program can be significantly altered by this method.

- When play becomes too easy the score required before repair, currently 1500, can be increased at line 620.
- There are a number of random factors used to give the program a different feel each time it is played and these may also be adjusted to suit.

The Deathwatch listing starts on Page 73

TCH

GAME OF THE MONTH



BEEB BITS from CLARES

BEEBSTICK:

Fully proportional high quality joystick complete with 4 programs. As reviewed in the November issue of 'BEEBUG'' **£29.95**

CASSETTE LEADS:

DIN to DIN + Remote	**£2.50**
DIN to 3 Jacks	**£2.50**
DRAGON Lead	**£2.50**
ORIC I (with motor control) – state DIN or Jacks	**£2.50**

MONITOR LEADS:

BNC to Phono	**£2.95**
Phono to Phono	**£1.50**
6 pin DIN to DIN RGB LEAD	**£2.50**
SERIAL PRINTER LEAD (Acorn Specs)	**£7.50**

All Leads are Top Quality and carry an Unconditional Guarantee.

SOFTWARE: ''GRAFKEY'' & ''GRAFSTIK''

These superb programs allow you to easily create graphics, diagrams, technical drawings etc. The drawing can then be saved to tape and included in your own programs by using the very short REDRAW routine provided. Modes include lines, rectangles, triangles, circles, write and all in up to 8 colours. A very special mode is the RUBBER BANDING (as seen in that famous HORIZON TV program). Now you can do it on your BEEB. Used in schools and industry. GRAFKEY is for keyboard and GRAFSTIK will work with ANY joystick. Data is common to both programs and will be compatible with GRAFPAD and GRAFPEN when available.

Cassette	**£7.95**
Disc	**£10.95**

☆ GRAFKEY & GRAFSTIK are incredibly powerful and flexible ☆

''JOYSTICK GRAPHICS'' is similar to GRAFSTIK but only uses line mode giving more control over the lines, screen, scale and array . . . **£5.75.**

''JOYSTICK PACK ONE'' contains ZAP & SKETCH (two of the programs free with BEEBSTICK'' . . . **£5.75.**

ALL PRICES INCLUSIVE OF VAT & CARRIAGE – NO EXTRAS

CLARES
222 Townfield Road,
Winsford, Cheshire CW7 4AX
Tel: 06065 51374

BIG IN LITTLE COMPUTERS

We probably carry the best stock of games and programming software for the BBC that you'll find anywhere

including the full range of Acornsoft, BBCsoft and many independent companies

THE·VIDEO·PALACE
62 Kensington High St. London W8.

THE VIDEO PALACE SOFTWARE
MAIL ORDER CATALOGUE
Send 25p p.o. + large s.a.e.

BBC OWNERS

Why not consider the HOBBIT FLOPPY TAPE SYSTEM for your computer?

The HOBBIT gives you all the facilities you would expect from a floppy disc at a fraction of the price.

Brief Specifications

☆ Read/Write speed of 750 BYTES per second
☆ Capacity: 101K BYTES per CASSETTE
☆ Average access time 22 seconds
☆ Up to 138 FILES per CASSETTE
☆ Completely automatic – no buttons to press
☆ Fully built, boxed and tested. Just plug in and go
☆ System can support TWO DRIVES

Available from stock **PRICE £135.00 plus VAT**

Also available for NASCOM computers **PRICE £120.00 plus VAT**

Access and Barclaycard accepted

For more details contact:

Ikon Computer Products

KILN LAKE, LAUGHARNE, CARMARTHEN, DYFED, SA33 4QE. Tel: Laugharne (099 421) 515

A quick look at literature available for the BBC Micro

Read all about it...

Let Your BBC Micro Teach You to Program *by Tim Hartnell (Interface).*

WHILE this is a worthy attempt at teaching the beginner, I doubt that many people will learn to program exclusively from this book.

The initial rate of progress is far too fast. For example, FOR . . . NEXT loops are used many times before they are explained, and some of the programming examples surround the ideas they wish to illustrate with a host of unexplained concepts.

Having said that, if you are past the complete beginner's stage, or are fortunate enough to have somebody guide you over the initial hurdles, the large number of programs and topics discussed in the rest of the book will prove to be very valuable.

Programming the BBC Micro *by Peter Williams (Ed.) (Newnes).*

A RATHER nice book but not for the absolute beginner. If, however, you already have some knowledge of other computers, or are used to reading scientific or technical publications, you will appreciate the clear, uncluttered style of the book.

It does progress rather quickly (chapter two has you defining functions) but right from the start it is trying to teach you how to design programs, not just code them in Basic.

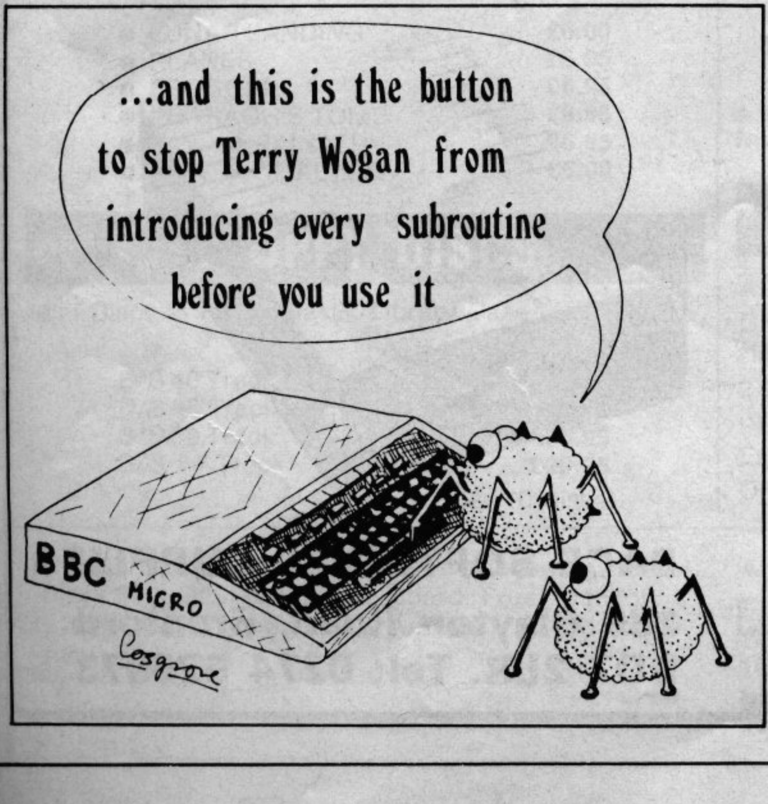
It also provides an excellent review of the potential of the BBC Micro, covering such topics as the A/D converter, interfacing, assembly language and the disc system. In this, it is way ahead of its rivals.

● *All the books reviewed here are from Haigh and Hochland, University Precinct, Manchester.*

Easy Programming for the BBC Micro *by Eric Deeson (Shiva).*

DON'T be deceived by the friendly, chatty style of this book. The gentle manner disguises a well thought out approach to teaching the beginner not only BBC Basic but also program design.

Although I would quibble with the way some of the concepts are introduced, a lot of beginners are going to be grateful to Shiva for publishing this book.


...and this is the button to stop Terry Wogan from introducing every subroutine before you use it
BBC MICRO
Cosgrove

One of Cosgrove's cartoons from "Easy Programming for the BBC Micro"

Basic Programming on the BBC Microcomputer *by Cryer & Cryer (Prentice/Hall).*

A TEXTBOOK approach to the subject. It's not exactly the most exciting or creative approach but certainly thorough and well conceived.

With lots of activities and "points to thing about" provided to aid his understanding, the reader who works through this book will know a great deal about Basic programming on the BBC Micro.

Learning to Use the BBC Microcomputer *by Dane Gower.*

A SIMPLE, well illustrated introduction to the fundamentals of Basic programming, it only skims the surface of the subject.

30 Hour Basic *by Clive Prigmore (National Extension College).*

THIS book is not directly about BBC Basic but about Basic programming in general. As such, it is a very good textbook and will give the BBC user an understanding of Basic as it is used on other machines.

If you buy the book make sure that you obtain the BBC version, which specifies the amendments necessary for the BBC Micro.

Unfortunately, this approach of adapting a general text for a particular machine is bound to fail since it cannot cover the special features of that machine adequately. For instance, I can find no mention of the REPEAT . . . UNTIL loop or procedures, while the

→

From Page 43

graphics commands are neglected entirely.

It does, however, cover the fundamental aspects of Basic programming far more thoroughly than other titles.

Practical Programs for the BBC Computer and Acorn Atom *by David Johnson-Davies (Sigma).*

IF you are past the beginner's stage and want to broaden your horizons this is the book for you.

Don't be put off because it isn't exclusively devoted to the BBC (it covers the Atom too) or by its drab appearance. Inside there is a treasure trove.

Under the headings Games, Graphs, Words, Numbers and Compiler, the author describes a variety of techniques that will go a long way towards turning you from a dabbler into a serious programmer.

Not a book for light reading, it is, nevertheless, well worth having a copy.

The BBC Micro Revealed *by Jeremy Ruston (Interface).*

PROBABLY of most use to the assembly language programmer, this book looks at the memory locations and program and variable storage on the BBC Micro, together with a section on the 6845 CRTC, the chip that handles the video.

Although the book fails to detail really useful applications of the information supplied, these will readily become apparent to the more knowledgeable.

While of value to experienced readers, its lack of clear explanation makes it unsuitable for the beginner.

The Book of Listings *by Hartnell & Ruston (BBCSOFT).*

SUBTITLED "Fun Programs for the BBC Microcomputer," this book is, quite simply, excellent.

If you're not an expert programmer already, buy a copy and work your way through it. Each of the 36 programs is well described, thoroughly explained line by line, and clearly listed.

Also many of the programs are accompanied by "Suggestions for Improvement" which guide you towards creating your own programs with these as a basis. Extremely good value!

30+ Programs for the BBC Microcomputer *by Chris Evans (CJE).*

ALTHOUGH not in the same class as the last book, it is still a very useful collection of programs for the less experienced programmer to gain a lot of very useful techniques from, while also having a great deal of fun.

It is rather broader in scope than the BBCSOFT publication, containing educational, scientific and general utility programs as well as graphics and games.

Assembly Language Programs for the BBC Microcomputer *by Ian Birnbaum (Macmillan).*

A THOROUGHLY comprehensive, textbook approach to the subject. The first of the BBC Assembly Language books on the market, its rivals will have a great deal to do to be better than this.

Although I have one or two reservations about the book, anyone who conscientiously works through the text will have mastered the subject and will have gained in the process a large number of useful machine code utilities.

If you want to expand your horizons past Basic, this is the book for you.

FOR ALL THATS NEW FOR THE BBC **PACE** SOFTWARE SUPPLIES ☎ 0274 575973

Add the versatility of a disc drive to your BBC Computer

This superb precision disc drive produced by the world famous Camera manufacturers **Canon** is now available in this unique compact form from **PACE** at only

£169 + VAT

Note the following features:

- Colour matched to the BBC
- Slim compact design measuring only 8½" x 6" x 2½"
- Price includes all cables
- Postage and packing free

PACE SOFTWARE SUPPLIES

130 Clayton Road, Bradford
BD7 2LR. Tel: 0274 575973

BBC MICRO OFFERS FROM OPUS

TEAC DISC DRIVES

TEAC 55E Mini S/S 80 Track.
Formatted Single Density 200K Double Density 400K.

ONLY **£179.00**

TEAC 55F Mini D/S 80 Track.
Formatted Single Density 400K.
Double Density 800K.

ONLY **£229.00**

- Ideal for use with BBC Micro
- Low power consumption
- Slimline – latest technology
- Full warranty.

A DAISY WHEEL PRINTER ONLY £499

TEC STARWRITER FP 1500-25
25 CPS – Friction Feed – Serial Interface

Supplied with lead to your BBC.

GAMES

We are authorised dealers for A&F Software and can offer the following top quality cassettes for the BBC Model B.

● LUNAR LANDING	£6.00
● PLANES	£6.95
● FROGGER	£6.95
● PHARAOH'S TOMB	£6.95
●● NEW ●● PAINTER	£6.95
● TOWER OF ALTOS	£6.00

FLOPPY DISCS

Mini Discs in FREE Plastic Library Case

	ATHANA	NASHUA
S/S 40 Track	**£19.95**	**£16.95**
D/S 40 Track	**£24.94**	**£22.95**
S/S 80 Track	**£26.95**	**£25.95**
D/S 80 Track	**£29.95**	**£29.95**

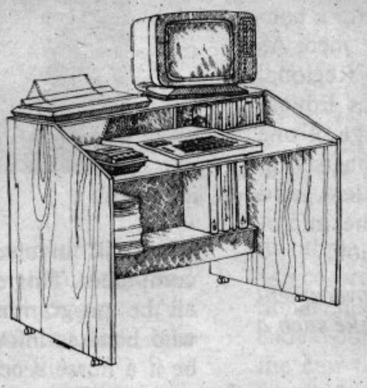
Prices per 10 discs.

22 INCH RGB COLOUR MONITOR ONLY £99.95

We have available a limited quantity of VMC 22 Colour Monitors with free isolating transformers. The Monitor has a 22″ Mullard 110°C CRT and for shipping purposes the CRT and scan coil assembly are separate from the chassis. The lugs of the CRT allow it to be mounted in a standard 22″ colour TV cabinet or a unit of your own design. The unit is assembled by plugging the wires from the chassis to the tube and soldering the power connector, input connector and isolating transformers. A comprehensive instruction sheet and circuit diagrams are included.

RGB Lead to connect the monitor to your BBC – ONLY **£4.50**

THE "ORGANIZER" DESK



ONLY
£49.50

- Teak finish
- On castors
- Self assembly
- Full instructions provided
- Top shelf for monitor/printer
- Large desk top area
- Lower shelf for paper/book storage – ample room in front of the shelf for you to sit comfortably.

THE MAGIC BOARD

A Memory Board for your BBC!

Gives up to 64K of Eprom storage/16K of additional RAM. Takes the following:

2716/2732/2764/6116/5516.

Plugs into an Eprom socket and fits inside your BBC! Easy to use – supplied with full software instructions.

ONLY **£29.95**

How to order:- Add carriage at the following rates – Discs 85p, Games & Magic Board, Free. Monitor £10.00. Other goods £7.00. Add VAT at 15% to the total.

Govt, Educational & Official orders welcome.

And send your order to:-

OPUS SUPPLIES

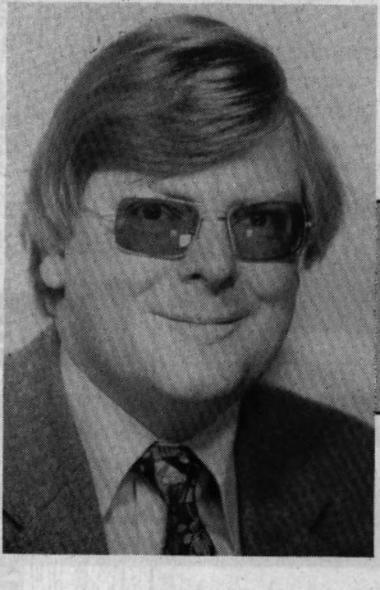
10 Beckenham Grove,
Shortlands, Kent BR2 0JO.
Tel: 01-464 5040 or 01-464 1598

Access

VISA

MEP

Spreading the micro gospel in education



ROBERT CHANTRY-PRICE, Director of the North West Regional Centre for the Microelectronics Education Programme, discusses the MEP's aims with Mike Bibby.

I FIRST met Robert Chantry-Price just over a year ago, upstairs in a tiny garret-like room, struggling with one of the early BBC Micros. "Ah yes," he said when I reminded him of it recently, "we've managed to get it working since then!"

Robert himself has been doing a considerable amount of work since then. As Director of the North West Regional Centre for the Microelectronics Education Programme, he is in charge of one of 14 centres the government has set up throughout England, Wales and Northern Ireland to spread the microelectronics "gospel" in education.

● ***I asked him why the government had felt it necessary to take such a step.***

"A government survey has forecast that in the near future 50% to 60% of jobs will involve the use of microcomputers. This doesn't mean that we'll all be programmers, but that anyone who handles information in any form – be it a nurse recording temperatures, or a rep. logging his day's sales – will be entering it directly into a computer of one sort or another rather than writing it down on paper.

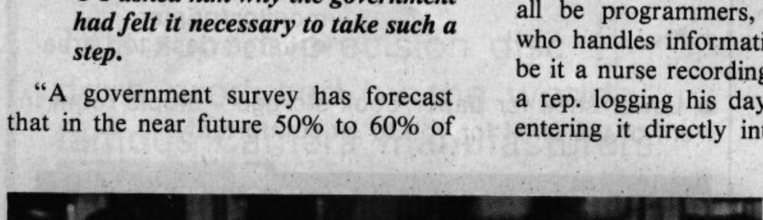
"If Britain is to be competitive in the future we will have to teach our schoolchildren about the new forms of microtechnology. Leaving familiarisation with computers until they are out at work is too expensive and too late.

"Our daily life will increasingly involve contact with microelectronic devices and systems, and we must prepare our children for such a society. To do so is the aim of our programme."

● ***But surely we cannot turn every lesson into a computer science session?***

"Of course not, but we can introduce the computer into a variety of educational contexts – not as something artificial that has been grafted on, but as a vital part of the curriculum.

"There are things you can do in education with the aid of a computer that are completely impossible otherwise. And the exciting thing is that we are still discovering new uses.



A word processor is used to maintain a directory of all educational software available to schools

Teachers at an in-service training course. They frequently display the same reactions to a micro as do their charges.

"If you like, we're at the stage Gutenberg was when he invented the printing press. You can imagine the reviewers of his Bible saying, 'Well you've invented the press and printed the Bible. Now what do you do with it? There isn't exactly a flood of books waiting to be printed, and the one you've done is full of misprints – monks may be old-fashioned, but at least they got it right.'

"At this stage in microelectronics education, I suppose we're open to much the same criticisms, but, like Gutenberg, we're heading in the right direction. At present we are only beginning to exploit the potential of the new technology, and we can't say what will emerge. You might say it's a leap into the dark. It is certainly a leap into the future."

● ***Fine, but who pays?***

"Well the government realised that a national policy was necessary, so, in April 1980 it set up our programme specifically to support the development of computer literacy in schools. We are a four year project, and have received a £10 million grant for that period.

"The Regional Information Centre has three main functions: Firstly, we act as co-ordinators between the educational institutions in our area, in an endeavour to ensure that awareness of the new technology is as widespread as possible.

"Secondly, we organise in-service training for teachers.

"Lastly, we try to facilitate curriculum development, particularly the production of new materials. After all, there is little point in the schools having machines if they haven't any satisfactory software to run on them."

● ***Yes, but even if your project is successful, how can schools, in these days of educational cutbacks, possibly afford to buy their own micros?***

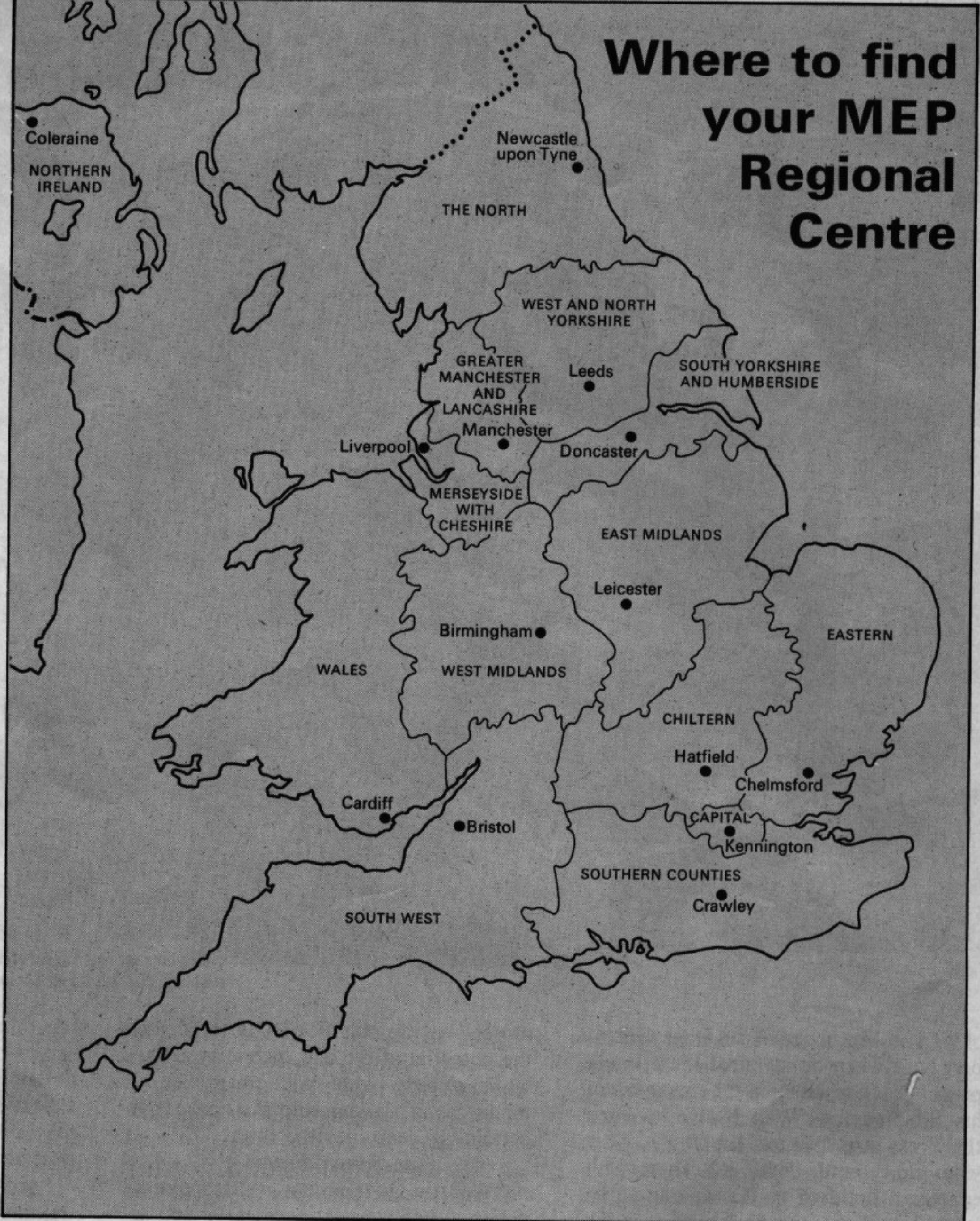
"In 1980 the Department of Industry offered £5 million worth of grants to ensure that every secondary school in the country has at least one microcomputer. Since then, they have offered

'There are things you can do in education with the aid of a computer that are completely impossible otherwise'

→

Where to find your MEP Regional Centre

The North
Resources Centre, Newcastle Poly.,
Coach Lane Campus,
Newcastle upon Tyne NE7 7XA.
0632 700424
Dir. R. Edwardson
W. & N. Yorkshire
Queenswood House, Leeds Poly.,
Becketts Park Site, Leeds, LS6 3QS.
0532 783437/8
Dir. R. Leigh
S. Yorks & Humberside
Educational Development Centre,
Chequer Road, Doncaster. 68935 x.53
Dir. Dr. P. Avis
E. Midlands
James Went Building,
Leicester Poly., P.O. Box 143,
Leicester LE19 1BH. 0533 551551
Dir. Dr. M. Bramer
Eastern
Chelmer Institute of H.E.,
Victoria Rd. South, Chelmsford,
Essex. 0245 354491
Dir. D. Want
Chiltern
Chiltern Regional Centre,
AUCBE, Endymion Road, Hatfield,
Herts. AL10 8AU. 070 72 66121
Dir. Dr. B. Tagg
Southern Counties
Southern Region Microelectronics
Information Centre, Furnace Drive,
Furnace Green, Crawley RH10 6JB.
0293 546216
Dir. P. Neate
South West
Bristol Poly., Coldharbour Lane,
Frenchay, Bristol BS16 1QY.
0272 656261
Dir. R. Margetts
Capital
ILEA Educ. Computer Centre,
Bethwin Rd., London SE5 0PQ.
01 735 1895
Dir. M. Doran
Wales
Welsh Joint Education Committee,
4th Floor, Arlbee House,
Greyfrairs Rd., Cardiff CF1 3AE.
0222 25511
Dir. L. Taylor
W. Midlands
MACE, Four Dwellings School,
Dwellings Lane, Quinton,
Birmingham B32 1RJ. 021 421 6361.
Dir. I. Glen
Merseyside with Cheshire
Regional Information Centre,
Rodney House, 70 Mount Pleasant,
Liverpool L3 5UX. 051 708 6620 x.27
Dir. Mrs S. Evans
G. Manchester & Lancs.
Manchester Polytechnic,
Didsbury School of Education,
799 Wilmslow Rd., Manchester
M20 8RR. 061 445 0780
Dir R. Chantry-Price
N. Ireland
MICRONET Centre, South Building,
New Univ. of Ulster, Coleraine,
N. Ireland. 0265 4141 x.341
Dir. H. McMahon


Coleraine
NORTHERN IRELAND
Newcastle upon Tyne
THE NORTH
WEST AND NORTH YORKSHIRE
GREATER MANCHESTER AND LANCASHIRE
Leeds
SOUTH YORKSHIRE AND HUMBERSIDE
Liverpool
Manchester
Doncaster
MERSEYSIDE WITH CHESHIRE
EAST MIDLANDS
Leicester
Birmingham
EASTERN
WALES
WEST MIDLANDS
CHILTERN
Hatfield
Chelmsford
Cardiff
Bristol
CAPITAL
Kennington
SOUTHERN COUNTIES
Crawley
SOUTH WEST

From Page 47

a further £9 million to primary schools so that, by 1984, each will have its own micro.

"Soon every school child will have access to a microcomputer. Our job is to ensure that they have both the software to run on it and the teachers to use it to its full educational potential."

● ***And which micro does the project recommend?***

"It's not our purpose to recommend a particular machine. Here at the centre we have examples of all of the makes of micros that the educational authorities in the Region have opted for. Similarly with software. We try to obtain copies of as many educational programs as we can.

"You see, if you want to buy a book you can pop down to a bookshop and browse until you find something that suits you. At the Regional Centre we aim to provide a venue where teachers can come and browse over the available range of micros and software.

"I would certainly encourage any of your readers involved in educational computing to pay us a visit."

● ***Finally, isn't it significant that the year all primary schools will have a computer is 1984? Are we facing a dehumanised, "electronic" future?***

"Not at all. It's true that computers will be useful in almost every field of work – but they can't give care to others. It takes human beings to do that.

"They can, however, get rid of a lot of the bureaucracy and repetitive tasks that often hinder the work of the caring professions. In this sense you could say that, far from dehumanising us, computers free us to be more fully human."

No apologies for beginning our regular review spot with tried and tested favourites. Based on familiar arcade games, these old faithfuls are as compulsive as ever – even more so in their BBC Micro versions.

Some might say that using such a sophisticated machine for games is a waste. Our team of critics haven't time to argue. For a start, they've got to destroy Atlantis, and then there's that frog to get across the road . . .

Frogger

A & F Software

THE idea of this game is simple, but its effects on the players are staggering. How can trying to hop a frog across a road, avoiding three lanes of traffic, then over a river via floating logs to safety reduce such normally near-sane people to febrile fanaticism?

You have to play it to understand the screams of triumph that greet the rescuing of a lady frog, empathise with the tragedy of encountering a snake, and know well the bitter taste of running out of time.

A truly brilliant games concept, this version makes excellent use of the graphics facilities of the BBC Micro. I also like being able to choose different sets of keys for movement. All too often even the best programs are ruined by such easily-remedied points as poor choice of control keys.

This piece of software suffers from no such flaws. It is tremendous fun to play – if you're looking for one game to suit all tastes and ages, this is surely it!

Invaders

IJK

HOW do you write an original review of a Space Invaders type game? We've all seen it before and played it many times. So what can you say that's new?

So if you were expecting something radically different you'd be disappointed with this package, and deservedly so. Invaders is an arcade classic whose integrity should be respected.

If, however, you are looking for a well designed, colourful version of the game which will give you many hours of pleasure, then this is the one for you.

It caters for the addicts by providing, not only the standard version, but such variants as slow or fast invaders and bombs, with or without shelters.

And for the real head-bangers out there, there are invisible invaders. Of that, all I can say is that if you enjoy this sort of game you probably deserve it.

To sum up, a worthy entrant to the ranks of Space Invader programs. All that's missing is the pint by your side, but I'm sure you'll be able to rectify that.

Atlantis

IJK

ONE thing that can be said about Atlantis is that it's awful. Whether it's awfully good or awfully bad I'm not so sure, but it left me irritated, frustrated and determined to improve.

The basis of the game is a submarine's attempts to probe the Lost City's defences using bombs, torpedoes and navigational skills to destroy and avoid all the mines and other nasties thrown at it.

I say probe, because in my case "navigational skill" means luck and although improving I have never got far enough to attack the city itself.

The main complication comes from the speed. You need quick reactions and almost clairvoyant foresight to be good, and it should appeal to those who prefer excitement to strategy.

Good nerves would also help, for the further into the game you survive, the tenser the situation becomes, and the more frustration when the inevitable catastrophe occurs!

Another cause for frustration is the layout of the keys, which I found awkward and irritating to use. But then, maybe my strategy of almost continuous firing is wrong.

All in all, Atlantis is a game I would advise trying before buying. If this kind of game appeals to you you'll love it. If not, save your money.

Space Pirates

Bug Byte

BEFORE I played this I was of the opinion that any games program for the BBC Micro which did not take advantage of the range of colours available on the machine would be severely limited.

Space Pirates proved me wrong. Based on the game Galaxians, it maintains the black and white of the original. Despite this, the play can build up to a fever pitch of intense concentration as you grapple with robotic space pirates whose sole aim is to make off with your life pods, ruthlessly destroying all who stand in their way.

As captain of a space cruiser, your defences against the sneak raids and massed attacks of these formidable opponents are just your laser cannon and superior manoeuvrability. The more you defy them, the more concerted their attacks.

And don't think that you can sacrifice your life pods to save your own miserable existence . . . they are the seeds of your future reincarnations. You'll need extra lives sooner than you think!

A simple theme, but the complex and devious ingenuity of the tactics evolved by the skilled player have to be seen to be believed. Definitely a game you won't tire of easily.

Billiards

H & H

WHAT a nice game! Gentle and thoughtful, it makes a civilised change from some of the hectic offerings reviewed.

The idea is straightforward enough, just a normal game of billiards with slightly different scoring. A cross directed by the cursor keys is used to aim the cueball, though allowance has to be made for the fact that the table is not quite flat.

Back spin is catered for, you choose on a range between 0 and 9, and also the force of the shot can be varied using the A to Z keys, A being a nudge, Z being a real whanger.

Simple in essence but with plenty of scope for skill, H & H have produced a satisfactory and involving game. Two people or two teams can play and it is a tribute to the programmers' ability that the agonised cries of "go in, go in" are exactly the same as to be heard around a real billiards table.

Hyperdrive

IJK

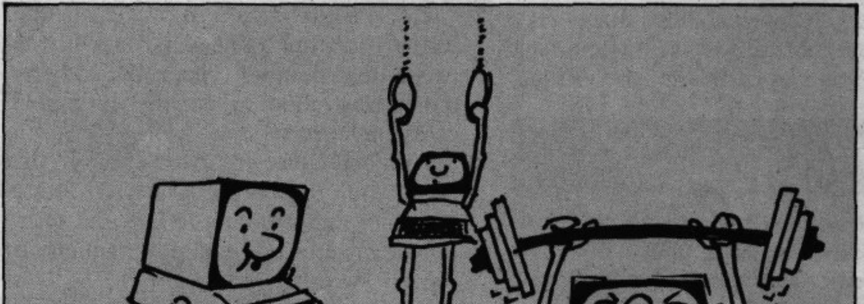
THIS is a simple but effective chase game set in a rudimentary maze. The cover story is that you are a space explorer captured by aliens who imprison you in the maze and then, with the occasional help of the delightful Evil Otto, they proceed to hunt you down.

To defend yourself you have the almost obligatory laser missiles. But beware – the more aliens you destroy the more come after you.

Based on speed and good reactions rather than on strategy, with nine levels of difficulty, Hyperdrive is fast, furious and fun.

Feeling a little weary, no bite to your bytes, no ram to your ROM? Then you really must take the . . .

Beeb Body building Course



By MIKE K. COOK

THIS course of exercises is designed to tone up and strengthen your computer muscles, and add a few that aren't even there at the moment.

Every month I will be looking at some aspect of the BBC Micro's hardware and explaining how to get the most out of it, or how to add bits to it to increase its capabilities.

The column will explore the world of hardware interfacing through a series of exercises, experiments and constructional projects.

While the exercises will be complete in themselves, I hope they will inspire you to extend them and make them fit your own particular requirements.

While most of the projects can be done exactly as published, there will be hints and tips for further work you may like to do.

But don't think you need be a whizz kid to follow these exercises, although you might be when you've finished them.

The BBC Micro offers the potential of being a very powerful general purpose computer/controller. It positively begs you to hang things on it.

The Basic interpreter has been fitted with the means to marry up a program to events happening in the outside world, and it is that tie-up that we are going to explore in this series of exercises.

For some of the more complex additions we will make printed circuit boards available, whereas others will be simpler and some will require no construction at all.

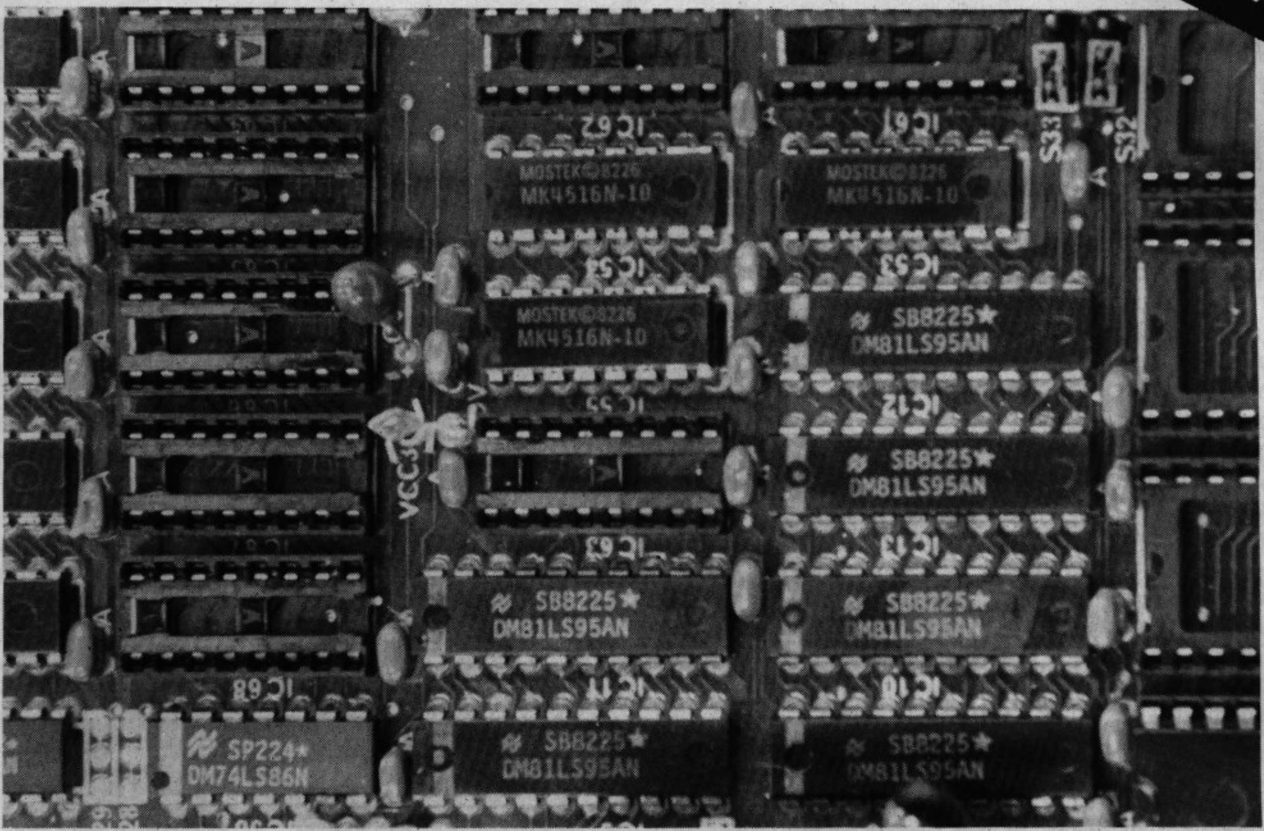
Any additional hardware is useless without software to exploit it so I will be giving examples of this, as well as outlining extra facilities you can implement.

From time to time I hope to be able to give you progress reports on our exercises and report back what you have done with them. To do this I will require feedback from you, so please feel free to write to me.

The address is: BBC Micro User, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY.

As a little sneak preview of what is coming up we will be looking into projects that involve controlling an electric train set, a voice control input and a way of connecting a TV video camera (the type used with your video tape recorder) to your BBC computer to enable it to see and print out pictures.

If you have a burning secret desire to connect something to your computer as an input or output device write and let me know and I will see if it can be done as one of our exercises.



Empty sockets awaiting RAM. Note how the chips are all the same way round – make sure yours are, too

Upgrading from A to B is a comparatively simple process

TO B or not to B, that is the question. Whether it is nobler in the mind to cough up the extra hundred quid or suffer the slings and arrows of a home-made update?

Well, that's how Shakespeare definitely would not have put it but it poses the question that we shall be exploring this month and next.

If you already have a model B, do not give up reading this just yet as I will be explaining exactly what you have got for the extra money along with some options you might not know you had.

However, if you own a model A computer it might just be that some money can be saved.

The price of the extra components is about half the price difference between the models A and B, and you may not even need all those components.

The upgrading of a BBC computer from a model A to a model B is a comparatively simple process involving some soldering and plugging in several chips.

However, not all the changes have to be made, as some of them add nothing to your machine now but will be needed only if you want to upgrade your computer even more in the future.

Fortunately the upgrade can be done in a modular fashion, and if you understand the purpose and function of each module you can decide whether to include or omit it.

Even if you want all the modules, you can still save yourself money as we shall see later.

Opening up a can of worms

This month I will concentrate on the parts of the upgrade that do not require any soldering, so that anybody can tackle them confidently. Next month I will describe the parts that do need soldering, so get practising now!

Before doing any modification it is advisable to unplug the computer and take off the lid. This is done by removing the four fixing screws that are imaginatively labelled "FIX". You will find two on the back and two underneath.

In fact, with the lid off the computer I cannot see how you can electrocute yourself as there are only low voltages supplied to the board.

I run most of my computers with the lid off as it saves time when I want to attach things to them.

However, I do not recommend you do this, not because I don't think you will be safe but because there is always some idiot who will find a way to electrocute himself and I am not being sued for damages because I told him it was perfectly safe.

Having removed the lid it is sometimes necessary to remove the keyboard as this covers up part of the main board.

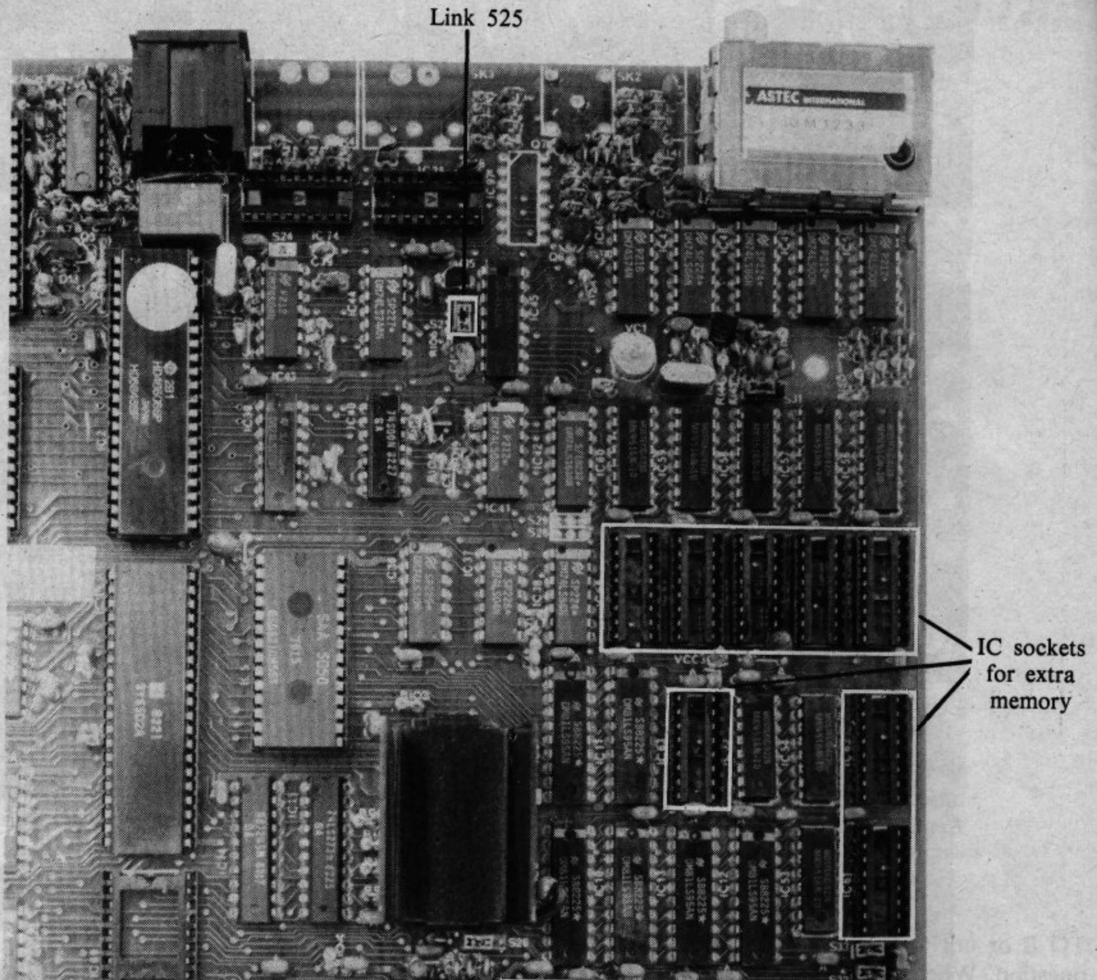
This is done by removing two or three (it depends when your computer was made) screws and nuts. The speaker connector can be removed by moving the keyboard gently away from the main board.

You will also need to disconnect the ribbon cable attaching the keyboard to the computer. This may be attached at both ends or just one by a socket and can be lifted straight off.

Check those wires well

If you need to remove the main board make a careful note of the seven wires coming out of the power supply onto the board: the red ones go to the connectors marked VCC and the black to the ones

→



From Page 51

marked OV, finally the short wire is attached to the connector labelled –5V.

Be very careful when removing them by gently rocking the spade connectors, as they have a tendency to break off. If they do, don't worry as the spade can be soldered back on the short stub that is left behind.

If you put these wires back the wrong way round you will certainly damage your computer.

Four self-tapping fixing screws now hold the computer board in place. Remove these and the main board can be tipped over.

It should now be held by only two short wires going to the BNC socket marked Video. These should be unsoldered or snipped close to the board if you want to remove it completely.

All of the upgrade modifications can be done without this final step.

Look out for rogues

At this point I am going to recommend something strange, namely that you put the whole thing back together again and test to see if it works!

You see, like all low-cost computers, the BBC is mass produced and, just like a car, you can get a rogue one that works just fine but once the board is removed some hidden gremlin appears that has been waiting for such an opportunity.

I recently supervised the upgrade of 14 computers and two of them had fine hairline cracks in the printed circuit board. This caused the computer to stop working when the board was unscrewed, and only by flexing the board could they be brought back to life.

The tracking down of such a fault is not a matter for a beginner. It even sends an experienced faultfinder round the bend!

It need not be a broken track. It could be a dislodged solder ball caused by the flow soldering process used in manufacture, or any of a dozen things.

The point of testing for this type of fault now is that it can be packed off back to your supplier without any of the hassle that you damaged the computer by wrongly installing the upgrade.

You now have to take the thing apart again but that's easy as you've done it before, haven't you?

As you now have access to the inside of your computer, we can now start our upgrade exercises.

Memory not too expensive

This is the most desirable upgrade to make and unfortunately the most expensive.

By adding an extra 16k of RAM (read write memory) you can bring the computer's total up to 32k. This will not only allow larger programs to be used or more data to be stored but will allow the full graphics capability of the computer to be used.

This is perhaps the most impressive feature of the BBC Micro and it is well worth having. The price of memory has tumbled dramatically over the last five years and it is now comparatively cheap.

When these memory chips were first introduced they cost £25 each. Today, do not pay more than £3 for them.

Unfortunately you will need eight of them, but if you have three friends it will be worth your while sending off for them together as you can get a price reduction: £2.80 off 8 ICs is typical for quantities over 25 and even more in 100-off quantities.

You may be puzzled at first as to what sort of memory chips you require. There is what is called a generic part number for this and most other devices that are made by several manufacturers.

However, this generic part number may not appear on the device or it may be changed in some way.

The chips you are looking for are called 4816, which are 16k dynamic RAMs with an access time of 100 ns (ns is short for nano seconds or 10E-9 of a second).

However, they might have on them MK4516N if they are made by Mostek or HM4816AP if made by Hitachi or even MB8118 manufactured by Fujitsu.

The only sure way is to make certain that the advert states "suitable for the BBC computer" or to tell the supplier that is what you want them for.

These devices, like some others in the upgrade, are MOS devices. This stands for Metal Oxide Silicon, which is the process used to manufacture them.

The point is that these are liable to damage by static electricity and so require special handling (or so the manufacturers say).

In truth, I have never damaged an MOS device and I have handled thousands. Whether this is due to the fact that they are made far more rugged than they were when they were first introduced or due to the simple handling precautions I take when using them I do not know.

However, it is probably wise to take a few precautions. Keep the devices in the original packing until you need them.

There are three ways you might receive them:

- In long plastic tubes which have an anti-static coating to keep them safe.
- In black conducting foam which keeps all the pins at the same electrical potential.
- In white expanded polystyrene pushed through aluminium foil.

If you have to replace a device on such a carrier, do make sure that when you push it in you are going through fresh aluminium and not through the same holes that were used before or you might just generate some lethal static.

When handling the device work quickly but do not rush. Remain seated to restrict body movement which might generate static, and before touching a new device touch some earthed device or the centre connector of a socket.

If you touch any connector other than the centre you will not achieve the desired results, and the next of kin will argue as to who gets the computer in your will!

‘It's better to be safe than sorry when you handle MOS devices’

The purpose of this strange behaviour is to drain any static in your body and allow your body capacitance to soak up any static you have generated during the operation.

I do know people who say this is a load of mumbo-jumbo, and that the devices are so rugged that you will have difficulty deliberately trying to damage them with static.

While I would not violently disagree with this, how many of you walk under ladders deliberately when you can easily step round them?

When the devices arrive, their legs will be slightly splayed out. This is to help automatic insertion devices in mass production.

This can lead to great difficulties when trying to plug in a device, so before you do, take all the leads down one side in the jaws of a pair of long nosed pliers and bend them slightly into the centre of the device. Repeat this for the other side.

If your pliers have a cutting blade in the centre, do not emulate a friend of mine who snipped off one of the legs.

Make sure that the device is the right way round. A notch or square marks the top of the device. If there are marks on both ends, the largest mark denotes the top.

The mark should be furthest away from you when looking at the computer from the keyboard end. In any event they should be in the same direction as all the other chips.

To insert a device, place all the legs down one side into the socket and bring the other side down to rest on the socket.

While still holding it, run your finger nail or screwdriver down the side and push each of the pins over the holes in the socket.

Gently push down, looking to see if all the pins have seated properly. When they have, push firmly down with your thumb and you will feel it go nicely home.

Then inspect the device to make sure no pins are still outside the socket or bent underneath it.

In writing the above I am aware that, like most simple physical actions, it sounds terribly complicated when written down. If you lack confidence get a friend to help/show/stand over you when you do the first one.

To complete the upgrade you need to insert all eight memory devices in IC sockets IC61 to IC68. These are all on the right hand side of the board (see photo opposite).

That puts the memory in, but the computer will not detect it on its own so you have to tell it that it is installed. This is simply done by changing link S25.

This link consists of three pins with a shorting pad connecting the lower two. Remove this by pulling at the shorting pad to remove it and replacing it on the top two pins.

When powering up, the computer tests the state of this link and sets the memory pointers accordingly.

If you have extra memory and this link is not changed, then there will be 16k of memory protected from Basic. This might be useful under some circumstances but as a general rule it should be changed.

It is a good idea to test each module of the upgrade as you complete it. In this way you know that if anything goes wrong it is something to do with what you have just done.

When you now power up your computer the display should read:

BBC Computer 32k
BASIC

If you have inserted the chips the wrong way round or failed to get all the legs in the sockets, you will have to remove them.

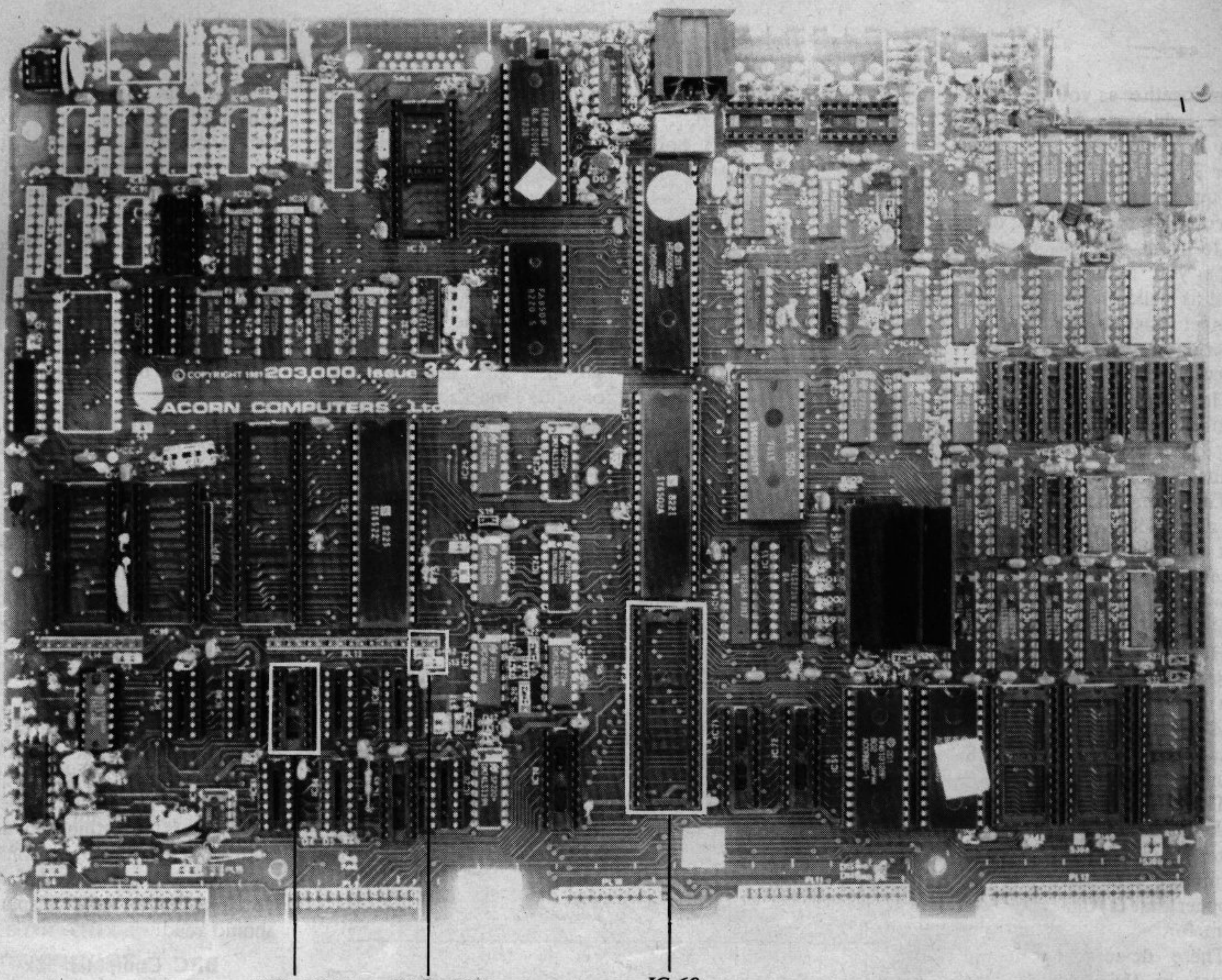
This might sound easy, and so it should be, but I have found that this is where the majority of damage is done by beginners.

It is possible to buy a special IC extraction tool (see photo). These grip the IC at both sides so that an even pressure can be applied. However, it is not necessary to have one of these if you take care.

Use a small screwdriver or a pair of inclined snipe-nosed pliers (my personal favourite) and gently lever one end of the IC.

Do not lever it all the way or you will be sure to break or severely bend the last two legs, but lever a little way and then

➡



IC76 ROM page select

Links 512 aand 513

IC 69 the VIA

From Page 53

go in from the other side.

By altering the sides you lever from, you will remove the IC in three or four goes.

Most ICs with a broken leg will have to be shot (or will have been) but you can always try your hand at a bit of surgery and try to solder it back on. After all, you have nothing to lose so you might as well have a go.

The next thing to fit is the 6521 VIA chip. This stands for Versatile Interface Adaptor and is a very complex chip.

We will be investigating its workings in this series – not in one fell, incomprehensible swoop but when and where we need to.

The VIA is needed for the user port and the printer interface, but more importantly for the time being it also contains a timer.

This timer is used by some of the programs supplied by Acornsoft to run on a model B computer, so in order to run these programs not only the extra memory but also the VIA chip has to be fitted.

Tricky little beast

As far as I know these are the only two requirements needed to run all the programs available for the model B at this time. All that is required is that it be plugged in.

However, as this is a 40 pin beasty it is a little more tricky than the memory chips, but the procedure is exactly the same. It is plugged into the socket labelled IC69.

If you want to fit the printer interface or the user port later, this chip is needed – so after the extra memory it is the most useful upgrade module.

Paged ROMs are the least immediately useful part of the upgrade. They allow ROMs other than Basic to be switched in, such as Pascal, Forth and a disc operating system.

However, at this time there are none officially available from Acorn. Also if your operating system is on four EPROMs there is no room to put any extra chips, so you definitely have no need to do this part.

However, if you have the sockets IC88 IC100 and IC101 free, and feel you might need to run an extra language or discs, then this is how to do it.

Plug in one chip, type 74LS163 into socket IC76, then locate the plug that connects the keyboard to the main board.

At the right hand side are two links with a yellow line around them, labelled S12 and S13. These should be snipped so that the contact is broken.

That's all that is needed to allow future expansion of the ROMs on your machine, but it does not need to be done until that expansion.

That's all for this month. Next month we will be looking at the remaining aspects of the upgrade and how to save over half the price of the components and still have a fully functioning machine.

PARTS REQUIRED

Memory Upgrade: 8 off 4816 16k 100 ns dynamic RAMs

VIA: 1 off 6521 VIA

Paged ROMs: 1 off 74LS163 Synchronous 4-bit counter.

Try tightening up your graphics technique with this

Triangular Technicolour Tangram!

By MICHAEL NOELS

SHAPES is a program that allows the construction of pictures by drawing coloured lines or triangles – a sort of triangular technicolour tangrams! It has the facility of saving the pictures constructed on tape – and loading them back. In fact a sequence can be displayed showing how a drawing was built up or different phases of a diagram. Alternatively you can construct a portrait gallery on tape.

As it stands, the program is ideal for testing out your graphic ideas before incorporating them in the code of your other programs. It can be a coordinates tutor for primary children and also demonstrates the triangular fill mechanism of PLOT 85 rather nicely – getting your points in the wrong order can cause the most unexpected results! Personally, I doodle with it a lot – it's quite therapeutic.

Shapes allows you three colours – red, blue and yellow – on a black background. This, however, is purely artificial and you can easily amend it to display the whole palette. I chose mode 1 for my display because I only needed four colours and preferred the proportions of the letters in that mode to mode 2. However, I give below details of the changes necessary.

As for fitting it into a model A, I'm not sure that it can be done. The program itself is just over 4k long before you dimension matrices and you need at least 10k of screen. However I've been extremely profligate of memory in the listing in an attempt to make it more readable, so you might be able to squeeze it in by getting rid of REMs and long variable names. You could also lose some of the data validation. I'd be glad to hear from anyone who manages it.

When run, the program gives you the choice of reading from tape or writing new pictures (which can be stored later). Assuming that you choose the latter (as you haven't got a tape to read from yet), you will see displayed a pair of axes which fill the graphics window. The horizontal axis ranges from 0-1000, the vertical from 0 to 750. In a text window at the bottom you will see displayed the two previous points "visited" – essential reading if you are to enter a third point to complete a triangle. Initially, both pairs of points are zero.

Pressing the space bar to continue then allows you to put in a new point. Try entering out of range data. Having input the coordinates, you are asked if you accept them. If so you can opt to:

A: Draw a triangle between that point and the last two visited (as in PLOT 85);

B: Draw a line between the point just entered and the last point;

C: Simply carry on.

The last option is useful for just visiting points that will later be part of a triangle – often MOVE is used for this purpose. If you choose a triangle or line you will be given a choice of colours.

Continuing in this way, you will be able to enter a maximum of 13 lines and triangles before being forced to stop. (If you've got the memory, you can alter this – it was all I needed.) On finishing writing you will be asked if you wish to save it. The rest is straightforward, as is loading from tape.

Two words of warning, however: Firstly, make sure that you have the cassette bugs fix in before you run the program if you're in OS 0.1. Secondly, the program assumes you're using remote and does not flag you to turn off the cassette. If you're using cassette file operations in the primary school it should certainly have remote.

While on that note, if you are going to use the program to teach coordinates might I suggest that although doodling on the screen has its place, children should also come to the computer with something prepared on squared paper. I suggest intervals of 50 on the axes to give a 20 x 15 grid.

The program itself is fairly straightforward. It consists of two "master" procedures: PROCwrite and PROCread. PROCwrite repeatedly calls PROCinput which takes care of inputting the points and displays the shapes by calling PROCfill for triangles and PROCline for lines.

The program holds details of the last three points visited in arrays xpoint%( ) and ypoint%( ). xpoint% and ypoint% hold the latest values input. Both PROCfill and PROCline call on these

➡

**TANGRAM . . . Chinese puzzle square cut into seven pieces to be combined into various figures.*

From Page 55

points when "drawing". Having done this they store the details of the form drawn in string array shape$( ). This array is indexed by shape% which keeps track of the number of shapes drawn and "blows the whistle" when it reaches 13. The string shape$( ) is of the form:

Character 1: "T" for triangle
or "L" for line
Character 2: logical colour number
Characters 3-6: STR$(xpoint%(1))
Characters 7-10: STR$(ypoint%(1))
Characters 11-14:STR$(xpoint%(2))
Characters 15-18: STR$(ypoint%(2))
Characters 19-22: STR$(xpoint%(3))
Characters 23-26: STR$(ypoint%(3))

Notice that each coordinate is embedded in a string four characters long (by FNlength) – this is to aid in decoding the strings when we read them in from tape.

Returning from PROCinput, PROCsave is called to give you the option of saving your creations on tape in the form of the strings described above.

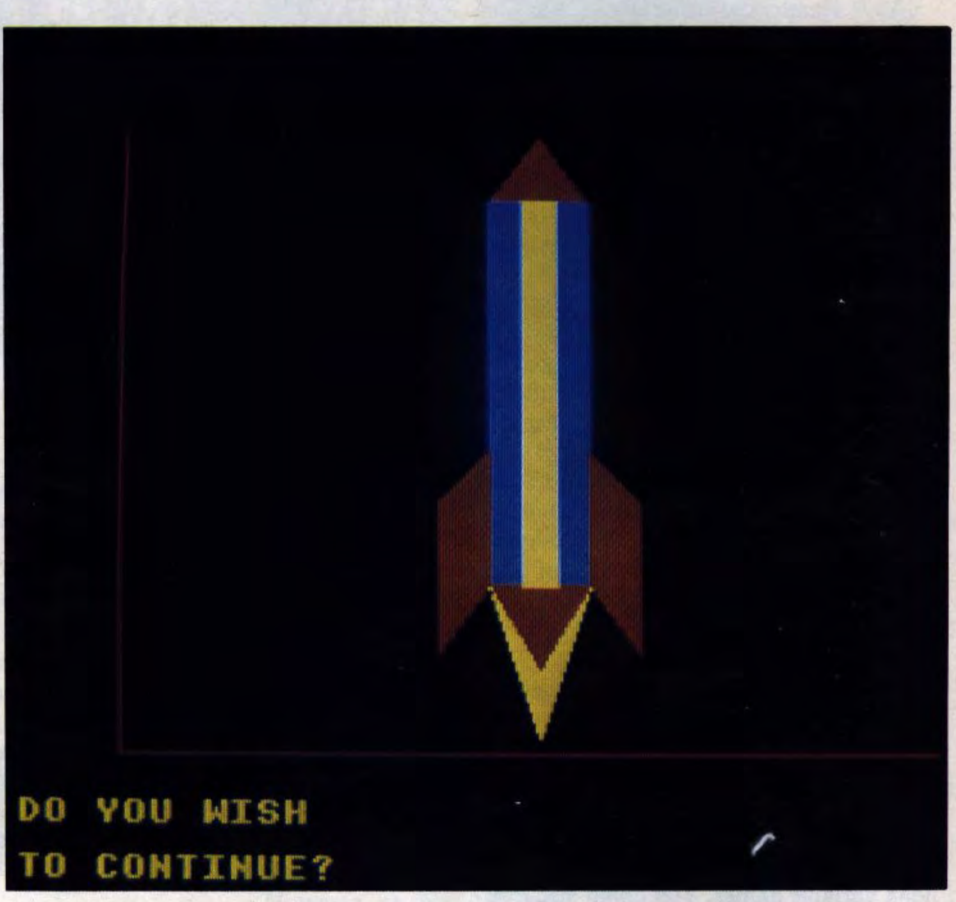
PROCread simply reads the data from tape and, on decoding the strings, uses either PROCTRIANGLE or PROCLINE to draw the appropriate shape.

Finally, if you wish to run the program in MODE 2, change the references to MODE 1 to MODE 2 in lines 170 and 180. You would have to alter FNcolour to take account of the new colours, and also change the format of string storage on tape to allow for two-digit string numbers.

You would also want to omit the VDU 19 statements in PROCread and PROCwrite. You might then find the text colours rather strange, but you can easily alter that, can't you . . .?

Shapes listing

```
   10 REM *** MICHAEL NOELS '83 ***
   20 REM ***      SHAPES       ***
   30 DIM shape$(12)
   40 DIM xpoint%(3),ypoint%(3)
   50 REPEAT
   60 PROCinitialise
   70 MODE6
   80 VDU 19,0,4;0;
   90 PRINT TAB(1,5);"DO YOU WISH TO :-"
  100 PRINTTAB(8,9);"A.Read pictures fro
m tape"
  110 PRINTTAB(8,12);"B.Write new pictur
es"
  120 PRINTTAB(8,15);"C.Finish with this
 program"
  130 PRINT TAB(10,21);"CHOOSE A, B OR C
"
  140 REPEAT
  150 key$=GET$
  160 UNTIL NOT(key$<"A" OR key$>"C")
  170 IF key$="B" THEN MODE1:PROCwrite
  180 IF key$="A" THEN MODE1: PROCread
  190 IF key$="C" THEN END
  200 UNTIL FALSE
  210 REM--------------------------
  220 DEF PROCwrite
  230 VDU 19,2,4;0;
  240 VDU 19,3,3;0;
  250 PROCaxes
  260 REPEAT :PROCinput
  270 UNTIL FINISH OR FULL
  280 PROCsave
  290 ENDPROC
  300 REM--------------------------
  310 DEF  PROCinitialise
  320 shape%=0
  330 xpoint%=0:ypoint%=0
  340 FULL=FALSE:FINISH=FALSE
  350 ENDPROC
  360 REM--------------------------
  370 DEF  PROCaxes
  380 VDU 24,255;279;1279;1023;
```



```
DO YOU WISH
TO CONTINUE?
```

```
  390 VDU 28,0,31,19,25
  400 VDU 29,255;279;
  410 GCOLO,1
  420 MOVEO,0:DRAW 1000,0
  430 MOVEO,0:DRAWO,750
  440 ENDPROC
  450 REM--------------------------
  460 DEF PROCinput
  470 CLS
  480 COLOUR 1
  490 PRINTTAB(0,0)"PREVIOUS POINTS:-"
  500 COLOUR3
  510 PRINTTAB(5,2);"(";xpoint%(2);",";y
point%(2);")"
  520 PRINTTAB(5,4);"(";xpoint%(3);",";y
point%(3);")"
  530 COLOUR1
  540 PRINTTAB(0,6)"SPACE TO CONTINUE";
  550 REPEAT :A$=GET$
  560 UNTIL ASC(A$)=32
  570 CLS:COLOUR1
  580 PRINTTAB(0,0)"NEW POINT:-"
  590 PRINTTAB(0,6);" INPUT THEN RETURN"
;
  600 COLOUR3
  610 REPEAT
```

→

NEW from our BBC micros accessories range

GRAPHICS TABLET

Transfer your technical drawings or designs from pad to screen in seconds and in colour. 22'' × 27'' approx. Measures distances and areas, and moves drawings on screen ... **ONLY £75 plus £11.25 VAT** plus £4.50 p&p.

BBC HARDWARE

Model 'A' 16K RAM 32K ROM. Full colour, high resolution graphics ...... **£260 + £39 VAT** (£7 p&p)
Model 'B' 32K RAM 32K ROM. 16 Colour Graphics ... **£346.95 + £52.05 VAT** (£7 p&p)

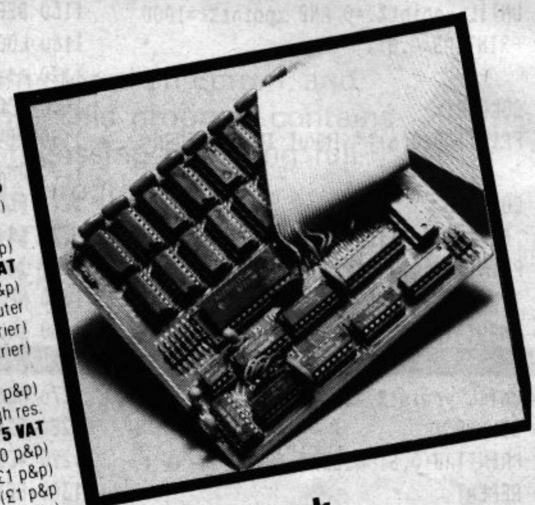
BBC Disk Interface ...... **£95 + £14.25 VAT**
BBC 'B' Upgrade Kit .... **£113.04 + £16.96 VAT** (£1.50 p&p)
BBC Single Disk Drive 100K bytes **£230.43 + £34.57 VAT** (£2.50 p&p)

14'' RGB Colour Monitor (as used in the BBC Computer Programme) .... **£270 + £40.50 VAT** (£9.50 Courier)
12'' Green Monitor **£82.60 + £12.40 VAT** (£6.50 Courier)
BBC Joystick ...... **£11.30 + £1.70 VAT** (£1 p&p)
Acorn GP 100 Printer ...... **£200 + £30 VAT** (£4.50 p&p)
Epson MX80 FT111 Printer, new model, dot matrix, high res. graphics, 80 or 132 char's per line ...... **£325 + £48.75 VAT** (£4.50 p&p)

Printer Cable (parallel) ...... **£13.04 + £1.96 VAT** (£1 p&p)
Tapes (Computer standard) ...... **£0.96 + £0.14 VAT** (£1 p&p any quantity)

Disks ('BBC' standard/pack of ten) ... **£19.50 + £2.93 VAT** (£1 p&p)

Books ...... Prices on application
Cover for BBC ...... **£4.99 + £0.75 VAT** (£1 p&p)
Cassette Recorders ...... **£25.22 + £3.78 VAT** (£3 p&p)
Teletext ...... available Early '83
Econet ...... available Early '83
Dual Disk Drives 800K ...... available Jan '83
Flochart Stencil ...... **£3.50 + £0.52 VAT** (50p p&p)
Acorn soft ...... List Prices
BBC Soft ...... List Prices



128K Ram Pack

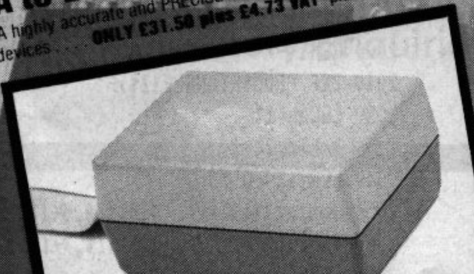
Simple plug-in memory expansion board, addressable for your own programs .... **Price £299 plus £44.85 VAT** plus £1 p&p.

FAN

For the professional man to keep the computer COOL .... **Price £33.25 plus £4.99 VAT** plus £1.50 p&p

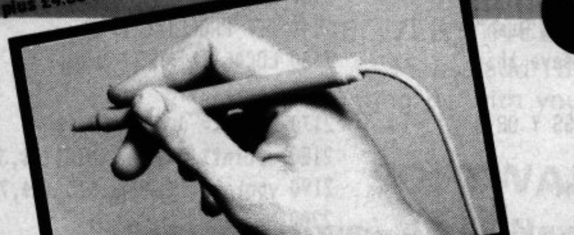
A to D

A highly accurate and PRECISE convertor for your external devices .... **ONLY £31.50 plus £4.73 VAT** plus £1.50 p&p



LIGHT PEN

A complete program with plug-in light pen that can be included in your program. Ideal for games and data input ... **ONLY £30 plus £4.50 VAT** plus £1 p&p.



Dealers and overseas distributors enquiries welcomed.

Mail or telephone order.
Barclaycard or Access
Credit Card accepted.

MICRO MANAGEMENT

Micro Management, 32 Princes Street, IPSWICH. Telephone 59181

Shapes listing

From Page 56

```
  620 PRINTTAB(0,2);"                    "
;
  630 INPUT TAB(0,2) "X COORDINATE",xpoi
nt%
  640 UNTIL xpoint%>=0 AND xpoint%<=1000
  650 PRINTTAB(0,6);"                    "
;
  660 COLOUR1
  670 PRINTTAB(0,6);" INPUT THEN RETURN"
;
  680 COLOUR3
  690  REPEAT
  700 PRINTTAB(0,4);"                    "
;
  710 INPUT TAB(0,4) "Y COORDINATE",ypoi
nt%
  720 UNTIL ypoint%>=0 AND ypoint%<=750
  730 COLOUR 1
  740 PRINTTAB(0,6)"ACCEPT THESE?(Y/N)";
  750 REPEAT
  760 A$=GET$:UNTIL A$="Y" OR A$="N"
  770 IF A$="N" THEN ENDPROC
  780 xpoint%(1)=xpoint%(2):xpoint%(2)=x
point%(3)
  790 xpoint%(3)=xpoint% :ypoint%(1)=ypo
int%(2)
  800 ypoint%(2)=ypoint%(3):ypoint%(3)=y
point%
  810 PLOT 70,xpoint%,ypoint%
  820 CLS:COLOUR1
  830 PRINTTAB(0,0)"YOU CAN CHOOSE TO"
  840 COLOUR3
  850 PRINTTAB(4,2)"A.Fill Triangle"
  860 PRINTTAB(4,3)"B.Draw Line"
  870 PRINTTAB(4,4)"C.Carry On"
  880 COLOUR1
  890 PRINTTAB(0,6)"PRESS A, B OR C"
  900 REPEAT :A$=GET$
  910 UNTIL A$="A" OR A$="B" OR A$="C"
  920 IF A$="A" THEN PROCfill
  930 IF A$="B" THEN PROCline
  940 IF A$<>"C" THEN shape%=shape%+1
  950 IF shape%>12 THEN FULL=TRUE:ENDPRO
C
  960 CLS
  970 IF A$<> "C" THEN PROCcontinue
  980 CLS:PRINTshape$(shape%)
  990 ENDPROC
 1000 REM ---------------------------
 1010 DEF PROCfill
 1020 LOCAL X$,X
 1030 X$="":X=FNcolour
 1040 GCOL 0,X
 1050 MOVE xpoint%(1),ypoint%(1)
 1060 MOVE xpoint%(2),ypoint%(2)
 1070 PLOT 85,xpoint%(3),ypoint%(3)
 1080 FORI%=1 TO 3
 1090 X$=X$+FNlength(xpoint%(I%))
 1100 X$=X$+FNlength(ypoint%(I%))
 1110 NEXT
 1120 shape$(shape%)="T"+STR$(X)+X$
 1130 ENDPROC
 1140 REM ---------------------------
 1150 DEF PROCline
 1160 LOCAL X$,X
 1170 X$="":X=FNcolour
 1180 GCOL 0,X
 1190 MOVE xpoint%(2).ypoint%(2)
 1200 DRAW xpoint%(3),ypoint%(3)
 1210 FOR I%=2 TO 3
 1220 X$=X$+FNlength(xpoint%(I%))
 1230 X$=X$+FNlength(ypoint%(I%))
 1240 NEXT
 1250 shape$(shape%)="L"+STR$(X)+X$
 1260 ENDPROC
 1270 REM ---------------------------
 1280 DEF FNlength(Y%)
 1290 =LEFT$(STR$(Y%)+"     ",4)
 1300 REM ---------------------------
 1310 DEF FNcolour
 1320 CLS
 1330 PRINT TAB(0,0)"CHOOSE A COLOUR"
 1340 PRINT TAB(4,2)" 1.Red"
 1350 PRINT TAB(4,3)" 2.Blue"
 1360 PRINT TAB(4,4)" 3.Yellow"
 1370 PRINT TAB(0,6)"PRESS 1, 2 OR 3"
 1380 REPEAT: A$=GET$
 1390 UNTIL A$="1" OR A$="2" OR A$="3"
 1400 =VAL(A$)
 1410 REM ---------------------------
 1420 DEF PROCcontinue
 1430 CLS
 1440 PRINTTAB(4,1)"DO YOU WISH"
 1450 PRINTTAB(4,3)"TO CONTINUE?"
 1460 PRINTTAB(0,6)"PRESS Y OR N"
 1470 REPEAT:B$=GET$
 1480 UNTIL B$="Y" OR B$="N"
 1490 IF B$="N" THEN FINISH=TRUE
 1500 ENDPROC
 1510 REM ---------------------------
 1520 DEF PROCsave
 1530 CLS
 1540 COLOUR1
 1550 IF FULL THEN PRINTTAB(0,0)"PICTURE
 IS FULL"
 1560 COLOUR3
 1570 PRINT TAB(4,2)"Do you wish"
 1580 PRINT TAB(4,4)"to save this?"
 1590 COLOUR 1
 1600 PRINT TAB(0,6)"PRESS Y OR N";
 1610 REPEAT:A$=GET$
 1620 UNTIL INSTR("YN",A$)
 1630 CLS
 1640 IF A$="N"THENPROCmenu:ENDPROC
 1650 X=OPENOUT "PICTURE"
 1660 PRINT#X,shape%-1
 1670 FOR I%=0 TO shape%-1
 1680 PRINT#X,shape$(I%)
 1690 NEXT
 1700 CLOSE#X
 1710 CLS:PROCmenu
 1720 ENDPROC
 1730 REM ---------------------------
 1740 DEF PROCmenu
 1750 PRINTTAB(0,3)"Any key returns"
 1760 PRINTTAB(0,6)"    to menu "
 1770 A$=GET$:ENDPROC
 1780 REM ---------------------------
 1790 DEF PROCread
 1800 FINISH=FALSE
 1810 VDU19,2,4;0;
 1820 VDU 19,3,3;0;
 1830 REPEAT
 1840 CLG:PROCaxes:CLS
 1850 COLOUR3
 1860 PRINTTAB(0,3)"PRESS PLAY ON TAPE"
 1870 X=OPENIN "PICTURE"
 1880 INPUT#X,R%
 1890 FOR I%=0 TO R%
 1900 INPUT#X,shape$(I%)
 1910 NEXT
 1920 CLOSE#X
 1930 FOR I%=0 TO R%
 1940 IF LEFT$(shape$(I%),1)="T" THEN PR
OCTRIANGLE(shape$(I%))
 1950 IF LEFT$(shape$(I%),1)="L" THEN PR
OCLINE(shape$(I%))
 1960 NEXT I%
 1970 PROCcontinue
 1980 IF FINISH THEN CLS: PROCmenu
 1990 UNTIL FINISH
 2000 REM ---------------------------
 2010 DEF PROCTRIANGLE(Z$)
 2020 LOCAL I%
 2030 L=LEN(Z$)
 2040 FOR I%= 0 TO 2
 2050 xpoint%(I%)=VAL(MID$(Z$,3+I%*8,4))
 2060 ypoint%(I%)=VAL(MID$(Z$,7+I%*8,4))
 2070 NEXT
 2080 GCOL0,VAL(MID$(Z$,2,1))
 2090 MOVE xpoint%(0),ypoint%(0)
 2100 MOVE xpoint%(1),ypoint%(1)
 2110 PLOT 85,xpoint%(2),ypoint%(2)
 2120 ENDPROC
 2130 REM ---------------------------
 2140 DEF PROCLINE(Z$)
 2150 LOCAL I%
 2160 L=LEN(Z$)
 2170 FOR I%= 0 TO 1
 2180 xpoint%(I%)=VAL(MID$(Z$,3+I%*8,4))
 2190 ypoint%(I%)=VAL(MID$(Z$,7+I%*8,4))
 2200 NEXT
 2210 GCOL0,VAL(MID$(Z$,2,1))
 2220 MOVE xpoint%(0),ypoint%(0)
 2230 DRAW xpoint%(1),ypoint%(1)
 2240 ENDPROC
```

SOFTWARE SAVERS

WORD PROCESSING PACKAGE.

Only **£22.85**

The most advanced word processing program stored on Eprom, and permanently on call inside your BBC machine. This program contains the most sophisticated features in word processing including full access to your existing business programs.

IF YOU ARE NOT CONVINCED, WE GUARANTEE TO REFUND YOUR MONEY AND POSTAL EXPENSES.

	Cassette	Disc (Format 40)
Sales Ledger	£10.00	£10.00
Purchase Ledger	£10.00	£10.00
Pay Roll	£10.00	£10.00
Invoicing	£10.00	£10.00
Filing	£10.00	£10.00
Home Accounts	£10.00	£10.00
Stock Control	£10.00	£10.00
Directory/Enquiries	£10.00	£10.00

Dual Disc with own Power Supply **£350.00**

Eprom 2765 **£6.95** each

DELIVERY INCLUDED IN ALL PRICES!
Please add 15% VAT to all prices.
To order, ring us with your Credit Card No., or write to:

SOFTWARE SAVERS,
Temple House, 43-48 New Street, Birmingham B2 4HL.
Telephone: 021-643 4577. Telex: 337045

Pick a random and Bingo you

By PETER DAVIDSON

RANDOM numbers are easily generated on the BBC Micro. If you type:

PRINT RND(3)

one of the numbers 1, 2 or 3 will be generated and appear on the screen. In general:

PRINT RND(N)

will generate a "random" number from 1 to N (inclusive), provided that N is a whole number (except 1).

Unfortunately, as with most micro-computers, the random numbers are generated from a series. This means that if you switch off your machine and type for example, PRINT RND(5) you will always obtain the same result.

To prevent this happening we must "seed" the random number generator. This is done by using the function RND(–N).

The series then used to generate random numbers later in the program will then depend on the value of N. This can be useful for debugging programs, but we do not usually want a fixed series of numbers.

One way round this is to use –TIME as the parameter for the seeding function, since TIME itself will always be different when the computer reaches the statement.

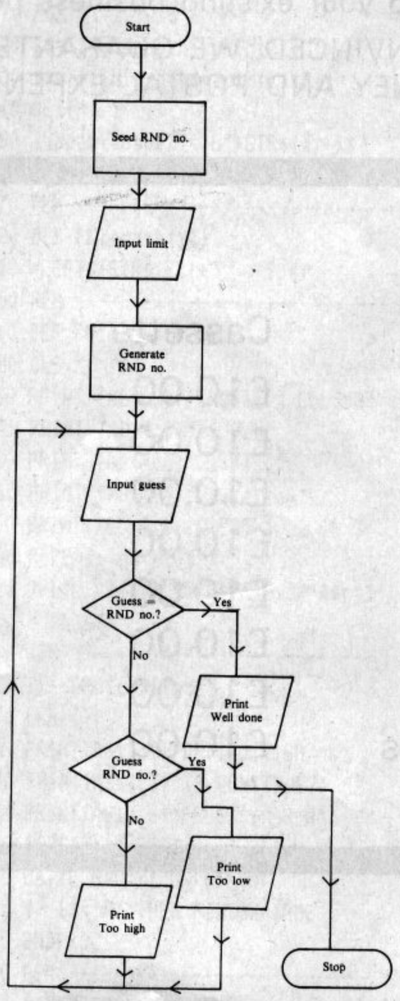
Now try typing in and running the following program:

```
10 X=RND(-TIME)      :REM sets seed
20 FOR n = 1 TO 10   :REM start loop
30 PRINT RND(10)     :REM generates &
                      prints random
                      number
40 NEXT n            :REM end loop
```

It should be noted that although this article uses the two functions already mentioned, three other random functions are available:

- RND(1) which generates a random number from 0 to (but not including) 1.
- RND generates random numbers within a large range.
- RND(0) returns the same number as last generated by RND(1).

Using only the random techniques mentioned, and one or two simple statements, it is very easy to write some easy games. Here is a program with flowchart, for a simple guessing game for you to try.


Start
Seed RND no.
Input limit
Generate RND no.
Input guess
Guess = RND no.?
Yes
No
Print Well done
Guess < RND no.?
Yes
No
Print Too low
Print Too high
Stop

```
  10 X=RND(-TIME)
  20 INPUT"WHAT IS THE HIGHEST NUMBER AL
LOWED",LIMIT
  30 CHOSNO=RND(LIMIT)
  40 INPUT"WHAT IS YOUR GUESS",GUESS
  50 IF GUESS = CHOSNO THEN PRINT"WELL D
ONE" : STOP
  60 IF GUESS < CHOSNO THEN PRINT"TOO LO
W" : GOTO40
  70 PRINT"TOO HIGH" : GOTO40
```

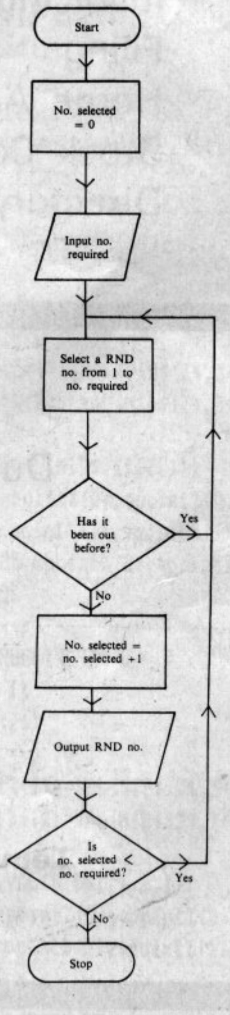
With this simple program, as with many others, no problem is caused if the numbers are repeated.

However, if we require several different random numbers a problem arises. The first idea one may have to achieve this is to generate a number and check that it has not already been generated before.

This method is shown in the following flowchart and program, which you may like to use to generate various quantities of random numbers (5, 10, 15, 20, etc.).

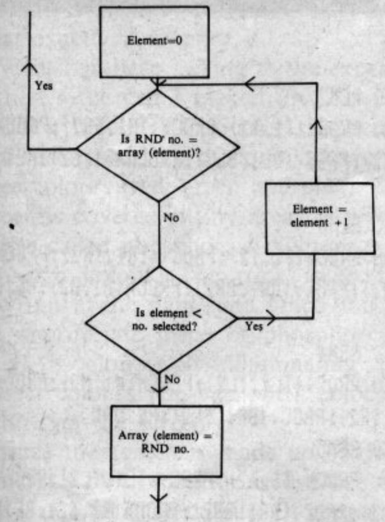
It is an interesting exercise to time the runs and record them on a graph. If this exercise is repeated for the next program also, the results can be compared.

As with all programs written for the BBC Micro the speed can be improved by shortening the variable names. This is the flowchart:


Start
No. selected = 0
Input no. required
Select a RND no. from 1 to no. required
Has it been out before?
Yes
No
No. selected = no. selected +1
Output RND no.
Is no. selected < no. required?
Yes
No
Stop

number, have got yourself a game!

Unfortunately the decision box "Has it been out before?" is not as simple as it may first seem. Numbers have to be stored and each new number generated has to be checked against all previously generated numbers. A more detailed section of flowchart to replace that box is:


Element=0
Yes
Is RND no. = array (element)?
No
Element = element +1
Is element < no. selected?
Yes
No
Array (element) = RND no.

And the program:

```
 10 X=RND(-TIME)
 20 INPUT"HOW MANY REQUIRED",NUMREQ
 30 DIM ARRAY(NUMREQ)
 40 MAXNO = NUMREQ
 50 NOSELECTED = 0
 60 RNUM = RND(NUMREQ)
 70 ELEMENT = 0
 80 IF RNUM = ARRAY(ELEMENT) THEN 60
 90 IF ELEMENT < NOSELECTED THEN ELEMEN
T = ELEMENT+1 : GOTO80
 100 ARRAY(ELEMENT) = RNUM
 110 NOSELECTED = NOSELECTED+1
 120 PRINTRNUM
 130 IF NOSELECTED < NUMREQ THEN 60
```

While the above method is acceptable for generating a few numbers, say selecting three winners of a prize draw, it is far too slow when the number of random numbers required is large and the chance of sticking in a loop, selecting numbers and finding that they have already been selected, is high.

Obviously another method is required. Try this one:

First, let's look at an analogy to the method to be suggested. Say we want to generate five random numbers from 1 to 5 without any repeats.

We could write the numbers on pieces of paper and put them in a row (the order does not matter, so numerical order is easiest). We now have five pieces of paper showing:

1 2 3 4 5

We next select a random number from 1 to 5, pick up the corresponding piece of paper, and move the others up to fill the gap.

Obviously, in this first case the number picked up will be the same as the random number. Suppose the random number was a 3. The pieces of paper will now look like:

1 2 4 5

We now select a random number between 1 and one less than last time (in this case 4). Suppose the number selected was a 3 again. We pick up the third piece of paper (a 4) and move the others up, leaving

1 2 5

Repeating the process again, if the random number selected was a 1, we would pick up a 1 and be left with

2 5

If on the next repeat a 2 was selected as the random number, the 5 would be picked up and nothing would need moving down (in the computer algorithm we in fact do move down the next number, but it will be too far along the row for the random number generated to cause it to be "picked up"). We are now left with:

2

This is obviously picked up. Thus by generating five numbers (which may contain repeats) in our example:

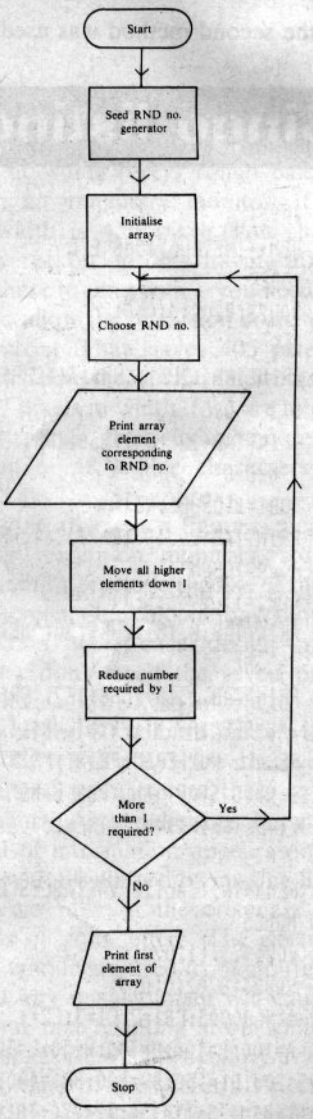
3 (a random number from 1 to 5)
3 (a random number from 1 to 4)
1 (a random number from 1 to 3)
2 (a random number from 1 to 2)
1 (the only one left)

we have selected five random numbers without repeats:

3 4 1 5 2

The flowchart and program for this method follows. It should be noted that "initialise array" means fill the array from element 1 to 1 more than the highest number with the corresponding number.

One more is required so that "move all elements above down one" always works, even if the last number is selected first time round the loop.


Start
Seed RND no. generator
Initialise array
Choose RND no.
Print array element corresponding to RND no.
Move all higher elements down 1
Reduce number required by 1
More than 1 required?
Yes
No
Print first element of array
Stop

```
 10 INPUT"HOW MANY REQUIRED",NUMREQ
 20 DIMARRAY(NUMREQ+1)
 30 FOR DUM = 1 TO NUMREQ+1 : ARRAY(DUM
)=DUM : NEXT
 35 REPEAT
 40 RNUM=RND(NUMREQ)
 50 PRINTARRAY(RNUM)
 60 FOR DUM = RNUM TO NUMREQ-1 : ARRAY(
DUM)=ARRAY(DUM+1) : NEXT
 70 NUMREQ = NUMREQ-1
 80 UNTILNUMREQ=1
 90 PRINTARRAY(1)
```

→

From Page 61

Care has to be taken in deciding which of the methods given is best in any situation. As already mentioned, the first would be suitable for selecting three winners in a prize draw as if, say, 1,000 tickets had been sold the chance of repeats is low and few checks have to be made.

If the second method was used in this example it would require up to 1,000 numbers to be shuffled three times and would be slower. On the other hand in a game of Bingo a lot of numbers have to be generated out of the 90. This means that the chance of repeats is high and the first method becomes far too slow after about the 20th number.

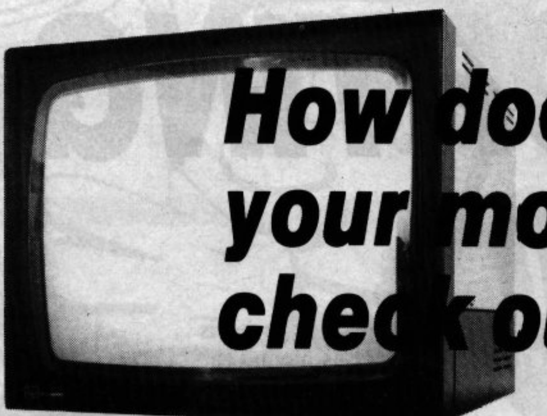
It is very easy to adapt the flowchart to give a Bingo program. All that is required is to provide several options after "reduce number required by 1" (e.g. recall numbers, output next number, start new game) and include a routine to print the numbers big on the screen. Obviously the numbers have to be "memorised" so that they can be recalled.

In the following bingo program the numbers are printed small for the caller and large for the audience. It is suggested that at least two television sets are used.

The program is listed below.

Bingo listing

```
  10 *FX11,0
  20 REM**INSTRUCTIONS ETC
  30 MODE7
  40 VDU23;8202;0;0;0;
  50 CLS
  60 PRINTTAB(12,5);CHR$136;CHR$131;CHR
$141;"B I N G O"
  70 PRINTTAB(12);CHR$136;CHR$131;CHR$1
41;"B I N G O"
  80 FORI=1TO5000:NEXT
  90 PRINTTAB(20,10);CHR$136;CHR$129;"B
Y PETER DAVIDSON"
  100 FORI=1TO5000:NEXT
  110 PRINTTAB(8,15);CHR$130;"NEXT GAME
STARTS SOON"
  120 PRINTTAB(0,18);CHR$132;"PRESS Z FO
R NEXT NUMBER":PRINT:PRINTCHR$132;"PRESS
 R TO RECALL NUMBERS":PRINT:PRINTCHR$132
;"PRESS N TO START ANOTHER GAME"
  130 X$=GET$:IFX$<>"Z"THEN130
  140 REM
  150 REM**INITIALIZE VARIABLES ETC
  160 MODE5
  170 VDU19,3,11,0,0,0
  180 VDU23;8202;0;0;0;
  190 @%=&00003:CB1=2:C1=3:C2=1
  200 A=100:B=100:H=300:W=50:L=300:BL1=1
50:BL2=200:B1=150:B2=200:BR1=400:BR2=200
:M1=150:M2=475:T1=150:T2=750:TL1=150:TL2
=500:TR1=400:TR2=500
  210 REM
  220 REM**BINGO PROGRAM
  230 NUMREQ=90
  240 DIMARRAY(91),RECALL(91)
  250 FOR DUM = 1 TO 91 : ARRAY(DUM)=DUM
 : RECALL(DUM)=DUM : NEXT
  260 REPEAT
  270 RNUM=RND(NUMREQ)
  280 IFNUMREQ<>90THENX$=GET$
  290 IFX$="R"THEN PROCrecap
  300 IFX$="N"THEN RUN
  310 IFX$<>"Z"THEN280
  320 NUMCALL=ARRAY(RNUM)
  330 COLOUR2:CLS:PRINTTAB(2,2)NUMCALL
  340 PROCbignum(NUMCALL)
  350 RECALL(NUMCALL)=TRUE
  360 FOR DUM = RNUM TO NUMREQ-1 : ARRAY
(DUM)=ARRAY(DUM+1) : NEXT
  370 NUMREQ = NUMREQ-1
  380 UNTILNUMREQ=1
  390 FORI=1TO5000:NEXT:CLS:PRINT:PRINT:
PRINT"LAST NUMBER IS ";ARRAY(1)
  400 PRINT:PRINT"ALL NUMBERS CALLED":FO
RI=1TO8000:NEXT:RUN
  410 REM
  420 REM**DEFINE PROCEDURES
  430 DEF PROCrecap
  440 CLS
  450 COLOURC1:PRINT"LAST NUMBER WAS ";N
UMCALL
  460 COLOURCB1
  470 FORDUM=1TO90
  480 IF RECALL(DUM)=TRUE THEN COLOURC1
ELSE COLOURC2
  490 PRINTDUM;
  500 IF DUM/6 = DUM DIV 6 THEN PRINT:PR
INT
  510 NEXT
  520 ENDPROC
  530 DEF PROCbignum(NUM)
  540 GCOL0,5
  550 VDU 29,0;0;
  560 IF NUM DIV 10 = 0 THENVDU29,315;0;
:GOTO590
  570 ON NUM DIV 10 + 1 GOSUB640,660,680
,700,720,740,760,780,800,820
  580 VDU 29,639;0;
  590 ON NUM MOD 10 +1 GOSUB640,660,680,
700,720,740,760,780,800,820
  600 ENDPROC
  610 REM
  620 REM**SUBROUTINES FOR NUMBER SHAPES
  630 REM0
  640 PROCh(T1,T2):PROCv(TL1,TL2):PROCv(
BL1,BL2):PROCh(B1,B2):PROCv(BR1,BR2):PRO
Cv(TR1,TR2):RETURN
  650 REM1
  660 PROCv(BR1,BR2):PROCv(TR1,TR2):RETU
RN
  670 REM2
  680 PROCh(T1,T2):PROCv(TR1,TR2):PROCh(
M1,M2):PROCv(BL1,BL2):PROCh(B1,B2):RETUR
N
  690 REM3
  700 PROCh(T1,T2):PROCv(TR1,TR2):PROCh(
M1,M2):PROCv(BR1,BR2):PROCh(B1,B2):RETUR
N
  710 REM4
  720 PROCv(TL1,TL2):PROCh(M1,M2):PROCv(
TR1,TR2):PROCv(BR1,BR2):RETURN
  730 REM5
  740 PROCh(T1,T2):PROCv(TL1,TL2):PROCh(
M1,M2):PROCv(BR1,BR2):PROCh(B1,B2):RETUR
N
  750 REM6
  760 PROCh(T1,T2):PROCv(TL1,TL2):PROCv(
BL1,BL2):PROCh(B1,B2):PROCv(BR1,BR2):PRO
Ch(M1,M2):RETURN
  770 REM7
  780 PROCh(T1,T2):PROCv(TR1,TR2):PROCv(
BR1,BR2):RETURN
  790 REM8
  800 PROCh(B1,B2):PROCv(BL1,BL2):PROCv(
BR1,BR2):PROCh(M1,M2):PROCv(TL1,TL2):PRO
Cv(TR1,TR2):PROCh(T1,T2):RETURN
  810 REM9
  820 PROCh(M1,M2):PROCv(TL1,TL2):PROCh(
T1,T2):PROCv(TR1,TR2):PROCv(BR1,BR2):RET
URN
  830 REM
  840 **REM PROCEDURES FOR VERTICAL & HO
RIZONTAL BLOCKS
  850  DEF PROCv(X,Y)
  860 MOVEX,Y:DRAWX,Y+H:PLOT85,X+W,Y+H:D
RAWX+W,Y:PLOT85,X,Y
  870 ENDPROC
  880 DEF PROCh(X,Y)
  890 MOVEX,Y:DRAWX,Y+W:PLOT85,X+L,Y+W:D
RAWX+L,Y:PLOT85,X,Y
  900 ENDPROC
  910 @%=&00003:CB1=2:C1=3:C2=1
```



How does your monitor check out?

By MICHAEL NOELS

I SUPPOSE that many of us, on moaning to our more knowledgeable colleagues about the illegibility of the 80 column modes on our domestic TV and our general lack-lustre graphics, have been told that what we need is a monitor. (Incidentally, why do people refer to the "domestic" TV – have you ever met a wild one?)

So probably, like myself, you've absorbed the idea that you must get a monitor, especially a colour monitor, if you are to have the quality of picture you deserve (although your wife and bank manager may remain rather sceptical). But, unless you're very different from me, you're not really sure what exactly a monitor is.

Well, I've been talking to the experts, so here's the gen I picked up.

On a colour TV picture the actual picture is made up of combinations of three colours (red, green and blue). The screen is covered in tiny areas of a substance called phosphor, a different type for each colour. The trick is to fire electrons at the right spot. Once you hit the appropriate piece of phosphor (or pixel) it glows. By illuminating the correct colours you can put a coloured picture on the screen.

Since the screen is made up of three colours, a TV or monitor needs three signals – one for each colour. Of course, in the case of normal TV reception the signal has to be broadcast. To simplify the affair they combine, or encode the three signals into one composite signal then beam that to your home. Your TV then unscrambles all this and supplies three signals to the screen.

Of course, you don't have to broadcast your signal from the BBC Micro to your set. If you do use an ordinary TV set with your micro, though, it generates the three necessary colour signals then has to combine them before they are sent, via the UHF output, to your TV which then decodes them – rather a long-winded way of doing things! Now, the point is that all this encoding and decoding causes a loss in quality of the signal.

With a colour monitor you take the RGB (red, green, blue) signal directly from the BBC Micro and send it to the tube without any of the intervening nonsense. Hence the theoretically better quality of monitors.

Right, we've decided that we need a colour monitor and have mortgaged the wife and kids. How do we choose an appropriate one?

Unless you really know what you are doing you do not choose on the basis of the figures the manufacturers supply. You see, there is no standard for such data, so measurements such as bandwidth have no great validity since you aren't comparing like with like. For example, bandwidth figures without values for skew and the decibel level of the measurements are meaningless.

You really need an expert to help you interpret these figures. However, there is still plenty you can do to evaluate a monitor. For a start, find out what power supply it uses. The quality of a monitor's picture consists of a chain of electrical and electronic links.

The power supply is the basis, and a poor one can ruin even the best monitor. For example, spurious signals called "noise" can be generated, particularly if the transformer is close to the coils of the tube. Its varying magnetic field can interfere with the "guns" that fire the electrons causing a rippling effect called "beating".

It is for this reason that those big cabinets you see arcade games in have the transformer as far away from the tube as possible. As a rule of thumb, a switched-mode power supply is better than the more conventional one.

Also, investigate how the signal gets to the tube. There are two methods, TTL and linear. The distinction between these is the same as that between digital and analogue respectively. The idea is that TTL signals provide better noise isolation. With linear you have to "filter" out the noise, losing some of the darker shades in the process.

Assuming that you have a monitor to test, switch on. Monitors and TVs differ in their workings. You have to turn off the interlacing with *TV (see the User Guide) and a mode change – you cannot do this in Mode 7.

The quality of the picture is ultimately controlled by the number of pixels per inch, and the more inches you have the better picture you will obtain.

Let's do some (very) rough calculations on an imaginary monitor. If the screen width is 450 pixels you should probably reckon on only having 90 per cent of these to play with – you need this border to allow the distortion at the edge of the screen. That leaves 405 pixels.

If we assume that a character must be at least 7 pixels in width if we are to read it clearly, this gives us a theoretical maximum of 58 legible characters per line ($405 \div 7 = 58$ approx).

Now, 450 pixels is a figure typical of the lower resolution monitors, so this would seem to preclude the use of the 80 column screen. Our calculations, though, are based on "worst-case" design – most characters don't need the seven pixels width we've allowed, so much of what you type in the 80 column mode will be legible. "M" and "W" are the widest characters so try a row of these to test your monitor. Also make sure that a true screenful of information appears on the monitor with no clipped or missing lines.

Look carefully at the crispness and whiteness of your letters. The electrons for each colour are fired from a different gun, and any misalignment will cause a bad colour mix resulting in off-white or colour fringes (this is particularly evident at the corners of the screen). Check to see that characters at different points on the screen are of uniform brightness.

Scan the screen for signs of wobble. If there is any, and you have turned the interlacing off, then some ripple from the power supply is coming through. This effect, even though slight, can become extremely wearing after a while.

Incidentally, do not be misled by terms such as "high" or "low resolution". Manufacturers use these terms very loosely, and some firms' hi-res monitors are to other firms lo-res.

● **NEXT MONTH we'll compare some of the leading makes of monitors and give you one or two programs to use while testing them.**

SORTING THINGS

— with the aid of a neat line in electronic cocktail shakers

By JOHN THORPE

KEEPING records from any list in some predefined order is useful because it makes the list easy to use, just as having the entries in a telephone directory or dictionary in alphabetical order makes them easy to find.

For this reason a large amount of the processing time used by any data handling system is taken up in the sorting of records, and it is useful to have a set of sorting routines available for inclusion in any program of this kind.

Before sorting can be carried out data must be entered into the system. Program 1 is a short Basic program to allow the entry of data to the sort. This program calls the procedure Procsort, which could be any of the sort procedures given below.

It is suggested that these procedures be typed in separately and saved using *SPOOL so that they can be added to your own programs using *EXEC.

Sorting involves rearranging the records in a list into order. For this to be done each record in the list to be sorted must include a key, which is the area of the record used to determine the final order.

In a telephone directory the key is the name of the subscriber, while in a dictionary the key is the word to be defined.

The algorithms discussed in this article will sort into order only the key and an index associated with that key. Records will not be moved. Once the keys have been sorted, however, it is easy to access the rest of the records in order. The method for doing this is to access the record pointed to by the index associated with the key.

In Program 1 this is done in lines 350-370.

One of the most straightforward and popular sorts available is the Bubblesort. This operates by repeatedly passing through the list to be sorted and comparing the keys in adjacent locations.

If a pair of keys is out of order then they are interchanged. As an example, consider a single pass of the Bubblesort on the data:

4 1 2 5 3

The first pass starts by comparing the first two elements.

4 1 2 5 3

As these two are out of order, they will be interchanged to leave the data in the form

1 4 2 5 3

The sort will go on to compare the second two elements.

1 **4 2** 5 3

These are also out of order, and will also be interchanged before the sort moves on to the next pair

1 2 **4 5** 3

This pair is in order already, so no interchange is needed, and the sort will proceed directly to the last pair.

1 2 4 **5 3**

The last pair will be interchanged, and at the end of the pass the list will look like this:

1 2 4 3 5

This list is already much closer to being in order than the original list, and a repeated set of passes will sort the list completely.

Any list containing N items of data will always be completely sorted by Bubblesort after N-1 passes. Some lists will be sorted earlier than this, and any list which needs N-1 passes before it is sorted is known as a *worst case.*

The two tables below show the list of data being sorted at the end of the pass. Pass 0 is the original data.

Data Set 1

Pass	*List*				
0	4	1	2	5	3
1	1	2	4	3	5
2	1	2	3	4	5
3	1	2	3	4	5
4	1	2	3	4	5

Data Set 2

Pass	*List*				
0	5	4	3	2	1
1	4	3	2	1	5
2	3	2	1	4	5
3	2	1	3	4	5
4	1	2	3	4	5

Proc 1. Simple Bubblesort

```
5000 DEF PROCSORT(N%)
5010 LOCAL A$,A,I%,J%,FLAG%
5020 N%=N%-1
5030 REPEAT
5040 FLAG%=TRUE
5050 FOR I%=1 TO N%
5060 J%=I%+1
5070 IF KEY$(I%)<=KEY$(J%) THEN 5150
5080 FLAG%=FALSE
5090 A$=KEY$(I%)
5100 KEY$(I%)=KEY$(J%)
5110 KEY$(J%)=A$
5120 A=INDX(I%)
5130 INDX(I%)=INDX(J%)
5140 INDX(J%)=A
5150 NEXT I%
5160 UNTIL FLAG%
5170 ENDPROC
```

Lines 5080-5140 manage the interchange of elements I% and J% in the list.

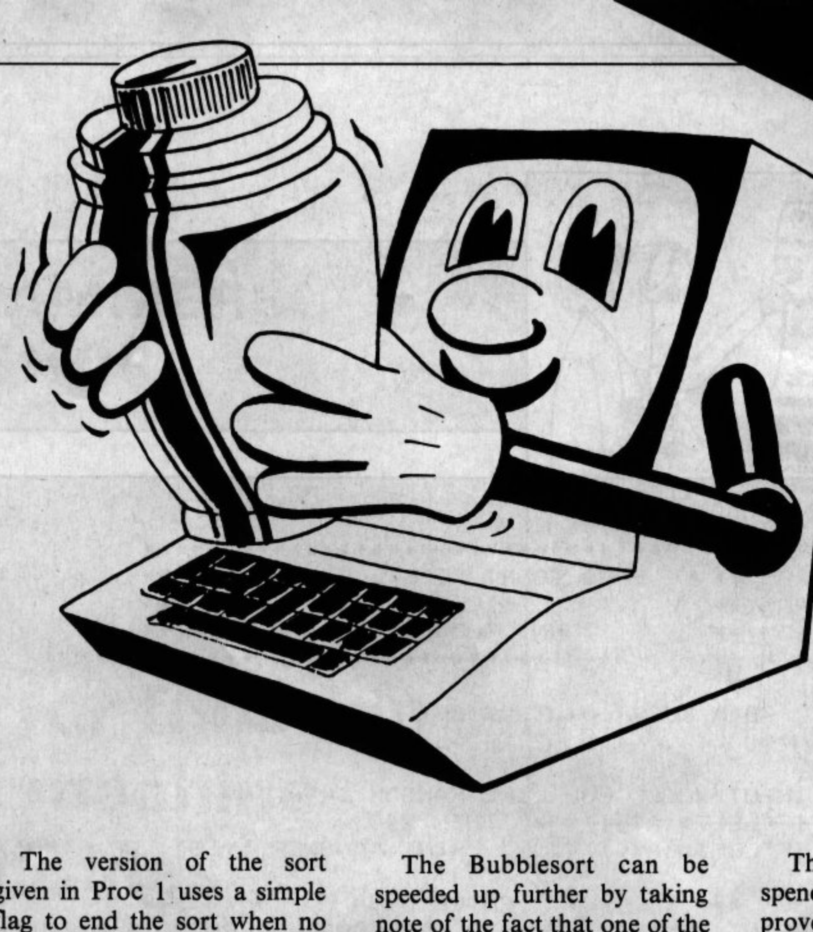
Line 5070 skips round the interchange section if elements I% and J% are already in order.

Lines 5050-5150 form a single pass of the sort.

Lines 5030, 5040 and 5160 cause the passes to repeat until no swaps occur.

Line 5020 reduces N%, the number of elements in the list, by one to give the number of pairs in the list.

OUT



Set 2 is an example of the worst case for the sort, so that the list is sorted completely only after pass 4. In Set 1 the data is already sorted at the end of pass 2, so that pass 3 and pass 4 are both wasted effort.

Clearly, any method which is able to stop the sort when the list is in order will save time when the sort is applied.

The version of the sort given in Proc 1 uses a simple flag to end the sort when no more interchanges are needed. At the start of each pass the flag is given the value TRUE. As soon as an interchange is made, the flag is set to FALSE. If the flag is still TRUE at the end of the pass, the data is in order and the sort ends.

The Bubblesort can be speeded up further by taking note of the fact that one of the effects of every pass is to move the largest element that is out of its correct place to the correct place for that element. This means that at the top end of the list there is a region in which the list is already sorted and will never change again during the sort.

The easiest way to avoid spending time trying to improve the order of an already sorted region is to set the flag variable equal to the position of the last swap in the previous pass. The current pass will then sort only as far as the position indicated by Flag, and Flag will then be reset.

→

FNPASS (Lines 5000-5140) manages the actual pass in the sort. If DIRECTION% is +1 the pass goes forwards; if DIRECTION% is –1 the pass goes backwards.

Line 5020 initialises the flag at +1000 depending on the direction of pass.

Line 5140 causes the function to return the value of the flag.

PROCSORT (Lines 5170-5260) manages the overall structure of the sort.

Lines 5190 and 5200 set the flags DOWN% and UP% to point to the first and last pairs of the list at the start of the sort.

Lines 5220 and 5240 preform the passes and adjust the flags.

Line 5230 stops the sort if all the elements are in order after a forward pass.

Line 5250 stops the sort when the two flags meet or cross over one another.

Proc 2. The Cocktail Shaker or Double Bubble sort

```
5000 DEF FNPASS (D%,U%,DIRECTION%)
5010 LOCAL I%,J%,FG%,A$,A
5020 FG%=-1000*DIRECTION%
5030 FOR I%=D% TO U% STEP DIRECTION%
5040 J%=I%+1
5050 IF KEY$(I%)<=KEY$(J%) THEN 5130
5060 FG%=I%
5070 A$=KEY$(I%)
5080 KEY$(I%)=KEY$(J%)
5090 KEY$(J%)=A$
5100 A=INDX(I%)
5110 INDX(I%)=INDX(J%)
5120 INDX(J%)=A
5130 NEXT I%
5140 =FG%
5150
5160
5170 DEF PROCSORT (UP%)
5180 LOCAL DOWN%
5190 DOWN%=1
5200 UP%=UP%-1
5210 REPEAT
5220 UP%=FNPASS(DOWN%,UP%,1)
5230 IF UP%<1 THEN 5260
5240 DOWN%=FNPASS(UP%,DOWN%,-1)
5250 UNTIL DOWN%>UP%
5260 ENDPROC
```

```
 10 REM ************************************
 20 REM **    BUBBLESORT  TEST  PROGRAM    **
 30 REM **       BBC   MICRO   USER        **
 40 REM **        JOHN  THORPE '83         **
 50 REM ************************************
 60
 70    DIM KEY$(60),INDX(60),REC$(60)
 80 N=0
 90
100 INPUT"WOULD YOU LIKE RANDOM DATA",A$
110 IF LEFT$(A$,1)="Y" THEN 240
120 IF LEFT$(A$,1)<>"N" PRINT "ANSWER 'YES'  OR  'NO' ": GOTO 100
130
140 REM **           ENTER DATA            **
150 PRINT "ENTER ITEMS TO BE STORED: TERMINATE WITH '****' "
160 N=N+1
170 INPUT "KEY",KEY$(N)
180 IF KEY$(N)="****" THEN N=N-1: GOTO 310
190 INDX(N)=N
200  INPUT "RECORD",REC$(N)
210 GOTO 160
220
230 REM **        GENERATE RANDOM DATA      **
240 INPUT "HOW MANY ITEMS",N
250 FOR K%= 1 TO N
260   KEY$(K%)=CHR$(RND(26)+64)
270   INDX(K%)=K%
280   REC$(K%)=STRING$(5,KEY$(K%))
285   PRINT KEY$(K%);TAB(12);INDX(K%);TAB(20);REC$(K%)
290   NEXT K%
295
300 REM **                 SORT             **
310 T=TIME
320 PROCSORT(N)
330 PRINT "SORT TOOK ";(TIME-T)/100;"SECONDS"
335
340 REM **              PRINT RESULT        **
350 FORK%=1 TO N
360   PRINT KEY$(K%);TAB(12);INDX(K%);TAB(20);REC$(INDX(K%))
370   NEXT K%
380 END
```

From Page 65

The sort ends when all the list is in the sorted region.

This can be achieved by alterations to lines 5020, 5040, 5080 and 5160 of Proc 1 and the insertion of line 5035. The lines should be amended to read:

```
5020 FLAG% = N% - 1
5035 N% = FLAG%
5040 FLAG% = 0
5080 FLAG% = I%
5160 UNTIL FLAG%<1
```

This principle can be used to improve the algorithm still further by creating sorted areas at both ends of the list. If alternate passes of the sort are in opposite directions, the passes in the conventional direction will produce a sorted area at the top of the list and passes in the other direction will produce a sorted area at the bottom.

The unsorted area in the middle will be smaller than before. This variation of the sort is known as the *cocktail* sort, or *double bubble*. Proc 2 is a pair of procedures which perform the double bubble.

The Bubblesort is one of a family of sorts which require, on average, a number of comparisons proportional to N^2 to sort N items.

Theoretically it is possible to devise sorts that can do this in only $N*Log_2(N)$ comparisons, but all the algorithms that do this need extra storage space. A later article will show how some of these faster sorts operate.

PROGRAMMERS' WORKSHOP

Testing for function keys in machine code routines

Introducing Programmers' Workshop, a forum for your ideas and problems, brainwaves and mysteries. If something is perplexing you, let us know. Likewise if you have a good idea, send it in – we'll pay.

We also intend to explain fully the ideas presented in these pages so that our readers aren't left with a clever trick that they can't understand and certainly couldn't adapt for use in their own programs. That way we all benefit.

THIS month's topic was suggested by Ian Hirst, who asked how it was possible to test for the function keys in machine code routines. He pointed out that in Basic this is fairly straightforward using INKEY( ) with a negative argument (see INKEY in the User Guide).

On the face of it, this should transfer easily to machine code via an OSBYTE call with the accumulator equal to &81.

Ordinarily such an OSBYTE call is used to read a key within a given time limit.

This limit is passed to the routine through the X and Y registers, which contain the delay in hundredths of a second (centiseconds).

X contains the least significant byte, Y the more significant byte. So, for a five second delay, i.e. 500 centiseconds, X would contain 244 (&F4) and Y would contain 1 since 1*256 +244=500.

Example I illustrates this: The program provides a five second delay between START and FINISH appearing on the screen. Any key pressed during the delay will be immediately printed out.

Lines 100 to 120 load the accumulator and X,Y registers with the values necessary for the OSBYTE call in line 130, while line 140 checks for Y being zero.

If during the delay a key closure is detected, Y is set to zero and the Ascii value of that key stored in X.

Hence the loop branches back to NOCHAR if Y is not zero, otherwise X is transferred to the accumulator which is then printed out with OSWRCH.

It is important to note that the number in X,Y is in two's complement form. This means that the maximum delay you can store in X,Y is &7FFF, since &8000 and above are negative in this system.

By using such negatives values of X and Y though, we can construct our machine code counterpart to the negative INKEY of Basic. To test for a key closure we use exactly the same number as we would put in the brackets of INKEY( ).

For example, to test for the letter "A" we would use INKEY(−66) in Basic. In machine code, we store −66 in X,Y using two's complement notation: −66 is &FFBE, so X contains &BE while Y contains &FF. As above, the accumulator contains &81 before we make the OSBYTE call.

The manual is none too clear about what happens next: If the key closure is not detected, X,Y are set to &0000, otherwise they are set to &FFFF. Example II illustrates the use of this call to test for *f*0. The loop is repeated until *f*0 is pressed.

Another way to test function key closure is to assign

```
10 REM USING OSBYTE CALL WITH ACC=&81
       X,Y CONTAINING &01F4 i.e. 500
       TO GIVE A FIVE SECOND DELAY.
20 REM A KEY CLOSED DURING THE DELAY
       SETS Y TO ZERO. X THEN HOLDS
       THE ASCII CODE OF THAT KEY.
30  DIM ROOM% 50
40 OSBYTE=&FFF4
50 OSWRCH=&FFEE
60 FOR PASS%=0 TO 2 STEP 2
70 P%=ROOM%
80 [OPT PASS%
90 .DELAY
100 LDA#&81
110 LDX#&F4
120 LDY#&01
130 JSR OSBYTE
140 CPY#&00
150 BNE NOCHAR
160 TXA
170 JSR OSWRCH
180 .NOCHAR
190 RTS
200 ]
210 NEXT PASS%
220 PRINT"START"
230 CALL DELAY
240 PRINT'"FINISH"
```

Example I

From Page 67

the keys an "unused" Ascii value – i.e. greater than 128. John Lord has sent in a procedure for assigning the values 129 to 138 to the keys *f*0 to *f*9. This is PROCSETUP in Example III.

In PROCSETUP, the loop defines each key in turn. It uses the idea that you can define *f*0 to have Ascii code 129 by using *KEY 0 ¦!¦A and so on.

Line 110 creates such a string in the "area" V%, dimensioned in line 90. (Note that using $V% to define text also places an &0D – i.e. a carriage return – at the end of the text.)

This string is then passed to the OSCLI routine at &FFF7 which is the command line interpreter. This acts as if the command were a string just typed in from the keyboard.

We have already set X% and Y% in line 90, so that we feed the X and Y registers with the low and high bytes respectively of the command string.

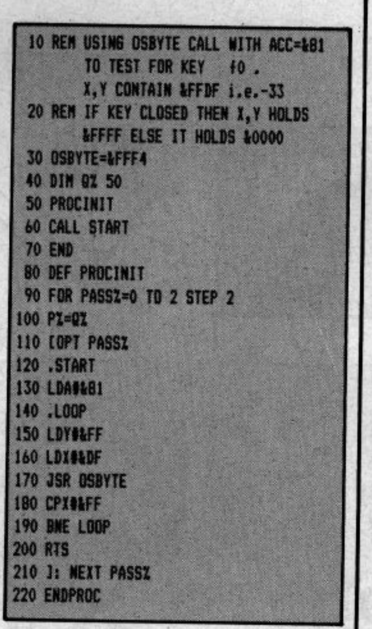
To demonstrate this idea we use a machine code routine. Lines 210 to 290 use OSRDCH to test for key closure values in the range 129 to 138, i.e. the function keys we have just defined.

Notice that line 220 checks for the escape key being pressed. This must be checked for and, if closed, must be at least acknowledged by the OSBYTE call of 240 and 250, otherwise you will return from the program to Basic. In this example we then continue with the main routine.

Line 300 simply subtracts 81 from the value of the key so that the Ascii value for "0" (i.e. 48) is held in the accumulator if *f*0 is pressed, the Ascii value for "1" (i.e. 49) if *f*1 is pressed, and so on.

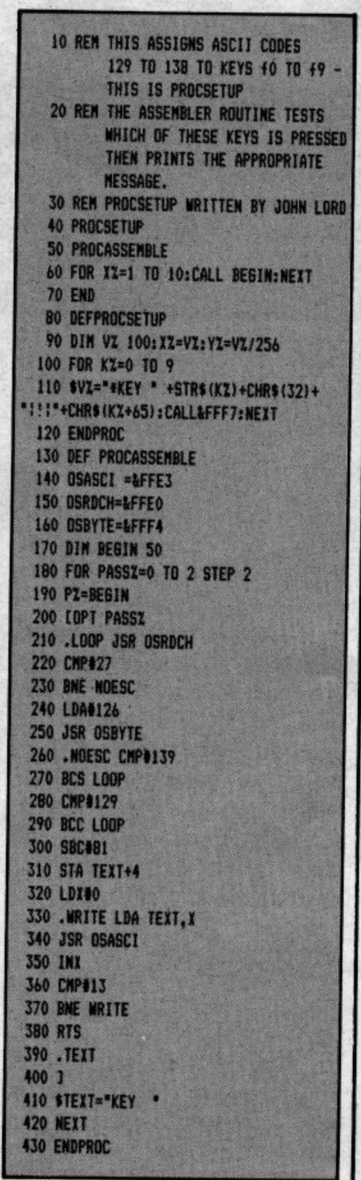
This value is then placed in the second space of the string stored at TEXT N.B. in line 410 the string is KEY followed by two spaces.

Lines 330-370 then print out this text, finishing after the carriage return (lines 360-370). So if *f*0 is pressed, the message KEY 0 is printed.)



```
 10 REM USING OSBYTE CALL WITH ACC=&81
       TO TEST FOR KEY   f0 .
       X,Y CONTAIN &FFDF i.e.-33
 20 REM IF KEY CLOSED THEN X,Y HOLDS
       &FFFF ELSE IT HOLDS &0000
 30 OSBYTE=&FFF4
 40 DIM Q% 50
 50 PROCINIT
 60 CALL START
 70 END
 80 DEF PROCINIT
 90 FOR PASS%=0 TO 2 STEP 2
100 P%=Q%
110 [OPT PASS%
120 .START
130 LDA#&81
140 .LOOP
150 LDY#&FF
160 LDX#&DF
170 JSR OSBYTE
180 CPX#&FF
190 BNE LOOP
200 RTS
210 ]: NEXT PASS%
220 ENDPROC
```

Example II



```
  10 REM THIS ASSIGNS ASCII CODES
        129 TO 138 TO KEYS f0 TO f9 -
        THIS IS PROCSETUP
  20 REM THE ASSEMBLER ROUTINE TESTS
        WHICH OF THESE KEYS IS PRESSED
        THEN PRINTS THE APPROPRIATE
        MESSAGE.
  30 REM PROCSETUP WRITTEN BY JOHN LORD
  40 PROCSETUP
  50 PROCASSEMBLE
  60 FOR X%=1 TO 10:CALL BEGIN:NEXT
  70 END
  80 DEFPROCSETUP
  90 DIM V% 100:X%=V%:Y%=V%/256
 100 FOR K%=0 TO 9
 110 $V%="*KEY " +STR$(K%)+CHR$(32)+
"¦!¦"+CHR$(K%+65):CALL&FFF7:NEXT
 120 ENDPROC
 130 DEF PROCASSEMBLE
 140 OSASCI =&FFE3
 150 OSRDCH=&FFE0
 160 OSBYTE=&FFF4
 170 DIM BEGIN 50
 180 FOR PASS%=0 TO 2 STEP 2
 190 P%=BEGIN
 200 [OPT PASS%
 210 .LOOP JSR OSRDCH
 220 CMP#27
 230 BNE NOESC
 240 LDA#126
 250 JSR OSBYTE
 260 .NOESC CMP#139
 270 BCS LOOP
 280 CMP#129
 290 BCC LOOP
 300 SBC#81
 310 STA TEXT+4
 320 LDX#0
 330 .WRITE LDA TEXT,X
 340 JSR OSASCI
 350 INX
 360 CMP#13
 370 BNE WRITE
 380 RTS
 390 .TEXT
 400 ]
 410 $TEXT="KEY  "
 420 NEXT
 430 ENDPROC
```

Example III

BBC

BBC SERVICE CENTRE
OFFICIAL STOCKISTS

Hardware	£
BBC Model A Microcomputer	299.00
BBC Model B Microcomputer	399.00
BBC Single Disc Drive (100K)	264.50*
BBC Teletext Receiver	224.25*
Microvitec 14" Colour Monitor	287.50
Sanyo 12" Green Screen Monitor	98.90
Sanyo Cassette Recorder	23.00
Analogue Joysticks	19.50
Cass. Leads 7/5 pin DIN + Jack	2.10
Cass. Leads 7 in DIN + 3 Jacks	2.00
Seikosha GP100 Printer	220.80
Seikosha GP250 Printer	263.00
Epson MX80FT/3 Printer	391.00
Epson MX82FT Printer	379.00
Epson MX100FT/3 Printer	506.00
Printer Lead – Parallel	15.29
Printer Lead – Serial	9.18

Sofware
Range of Acornsoft, Niblesoft, Program Power and Bug Byte Software.

Blank C-15 Cassettes at **46p** each.

BBC Upgrade Kits	
Complete A to B Kit	66.70
Disc Interface Kit	80.50
Partial Upgrade Printer	10.81
Partial Upgrade Memory	25.00
Partial Upgrade Analogue	10.81
Partial Upgrade Ser+RGB	13.16
Partial Upgrade 1 MHBus	9.14
Upgrade + Inst. + Test	
A to B	100.00
Memory	27.50
Printer	17.94
Analogue	17.94
Serial & RGB	19.55
1 MgHZ Bus	17.94
Books	
Creative Graphics	7.50
Graphs & Charts	7.50
Lisp Manual	7.50*
Forth Manual	7.50*
BBC Revealed	7.95
Basic Prog. on BBC	5.95
Let Your BBC Micro Teach You To Program	6.45
Prog. the 6502	10.75
A.L.P. for the BBC	8.95

* Please check availability.
All Prices INCLUDE VAT
P&P – Hardware & Ins. £3.00.
Software, Books etc. 50p.

dac
D.A. Computers Ltd.
184, London Road, LEICESTER, LE2 1ND.
Telephone: (0533) 549407

EXTENDED COLOUR–FILL GRAPHICS
E.C.F.G. GIVES YOU A CHOICE OF
!! 4 BILLION + !!
SHADES FOR TRIANGLE FILLING
IN BBC MODES 0,1,2,4 & 5

- PLOT 81 and 85 commands for triangle–filling have been adapted to use the ECFG fill–shade currently selected by new ECFG user–friendly commands. GCOL is still used for line colour.
- Easy choice of 17, 289 & 6561 subset colours between those normally available in 2, 4 & 16 colour MODEs. Further options include colours, angles, spacings & widths of cross–hatch etc.
- ECFG commands can be used in BASIC, typed from the keyboard, accessed in Assembler, or in future BBC Micro languages. ECFG is MOS–adaptive, and proven with versions 0.1 to 1.2
- Bootstrap from cassette rapidly builds an ECFG module at a RAM address pre–defined by PAGE, which is then automatically increased 512 bytes to allow immediate LOADing of programs etc.

Price : £10 inc : Mail Order only
GAELSETT Software
44 EXETER CLOSE, STEVENAGE, HERTS. SG1 4PW.
(Tel. Stevenage 51224)

SAVE MONEY!

Subscribe today!

BBC MICRO USER

–and get 12 issues for the price of 10!

Every owner of a BBC Micro – and everyone thinking of buying one – needs to get BBC Micro User every month. It's the biggest, brightest, most authoritive yet completely independent guide to a machine that has so much potential you will never tire of reading about its remarkable capabilities.

You can buy BBC Micro User from your local newsagent or station bookstall. Or you can take out a 12 months subscription and have it delivered by post.

As a special introductory offer we will send you the first 12 issues of BBC Micro User for just £10 – a saving of £2 on the normal price, plus free postage.

To take advantage of this offer, which is valid until March 31, 1983, fill in and return the coupon below.

No stamp is needed if posted in the UK.

You can also order by phone, quoting your credit card number and the expiry date.

Ring 061-456 4157

between 9am and 5pm

Special rates for schools: Send for our Bulk Order Form

SUBSCRIPTION FORM

Please send me the next 12 issues of BBC Micro User at the special introductory price of £10

Special offer applies to UK readers only. Overseas rates are given on Page 4

Name

Address

Signed

Card No.

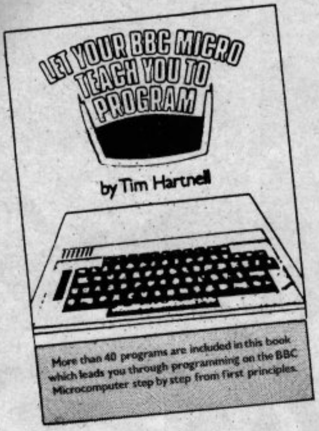
Expiry Date

Payment: please indicate method (✓)

☐ Access/Mastercharge/Eurocard
☐ Barclaycard/Visa
☐ American Express
☐ Cheque/P.O. made payable to Database Publications.

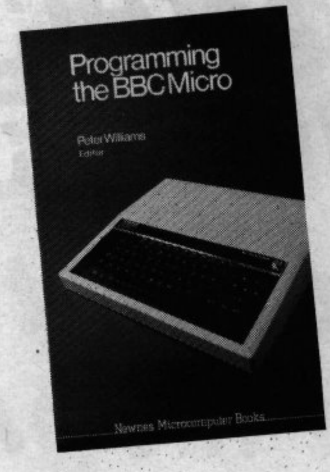
Send to: Database Publications,
FREEPOST, Europa House,
68 Chester Road, Hazel Grove,
Stockport SK7 5NY.
(No stamp needed if posted in UK)

BBC MICRO


LET YOUR BBC MICRO TEACH YOU TO PROGRAM
by Tim Hartnell
More than 40 programs are included in this book which leads you through programming on the BBC Microcomputer step by step from first principles.

For all but the absolute beginner, a useful companion for those wishing to learn BBC Basic. With many illustrative programs.

£7.45


Programming the BBC Micro
Peter Williams
Editor
Newnes Microcomputer Books

A thorough, thoughful, though high-paced review of elementary BBC lore. Includes topics such as the disc system and interfacing.

£7.50

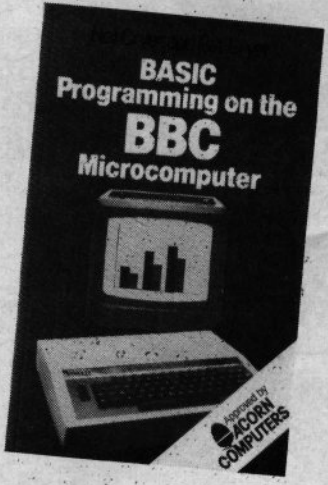
Probably the best elementary BBC Basic text. An exceptionally readable book which more than lives up to its title.

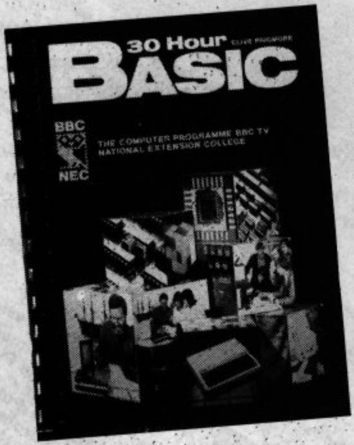
£6.95

Easy Programming for the BBC Micro
Eric Deeson
SHIVA's friendly micro series

A careful, textbook approach to the subject. It provides the reader with a firm grounding in BBC Basic techniques.

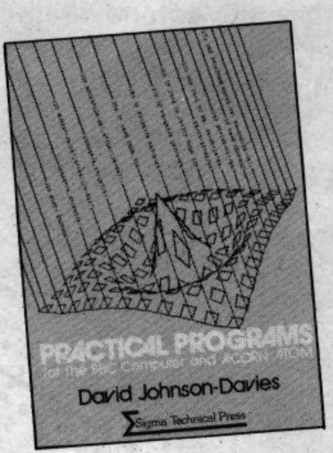
£6.95


BASIC Programming on the BBC Microcomputer
Approved by ACORN COMPUTERS


30 Hour BASIC
CLIVE PRIGMORE
BBC
NEC
THE COMPUTER PROGRAMME BBC TV
NATIONAL EXTENSION COLLEGE

A best-selling textbook. It teaches the Basic language in general, with special emphasis on the BBC Micro's dialect.

£6.50


PRACTICAL PROGRAMS
for the BBC Computer and ACORN ATOM
David Johnson-Davies
Sigma Technical Press

If you already know Basic and want to broaden your horizons, this is the book for you. It's full of fascinating ideas and projects.

£6.95

BOOKSHOP

ASSEMBLY LANGUAGE PROGRAMMING for the BBC MICROCOMPUTER
Ian Birnbaum

One of the best assembly language books ever written. Comprehensive, and specially compiled for the BBC Micro.

£9.95

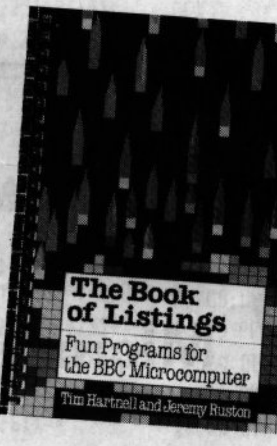
THE BBC MICRO REVEALED
Jeremy Ruston
The essential guide for the serious user of the BBC Microcomputer!

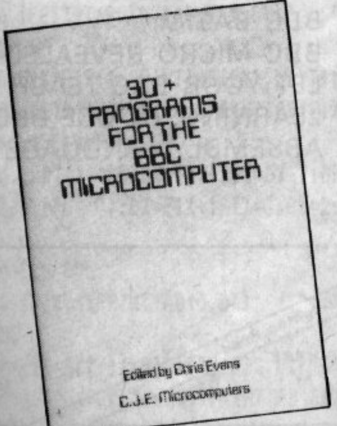
For those keen to explore the machine's "innards". It provides lots of useful facts on the CRTC registers and special memory locations.

£8.95

With 36 fun programs for the BBC Micro, this is exceptional value for money. It also gives many ideas for future projects.

£4.75


BBC SOFT
The Book of Listings
Fun Programs for the BBC Microcomputer
Tim Hartnell and Jeremy Ruston


30+ PROGRAMS FOR THE BBC MICROCOMPUTER
Edited by Chris Evans
C.J.E. Microcomputers

A useful assortment of programming ideas for the less-experienced programmer. It's also a useful source of enjoyable programs.

£5.95

ORDER FORM

All prices include postage and packing

Please supply the following book(s)

Please enter number required in box			£
☐	Let Your BBC Micro Teach You to Program	£7.45	....
☐	Programming the BBC Micro	£7.50	....
☐	Easy Programming for the BBC Micro	£6.95	....
☐	Basic Programming on the BBC Micro	£6.95	....
☐	30 Hour Basic	£6.50	....
☐	Practical Programs	£6.95	....
☐	Assembly Language Programming for the BBC Microcomputer	£9.95	....
☐	The BBC Micro Revealed	£8.95	....
☐	The Book of Listings	£4.75	....
☐	30+ Programs for the BBC Microcomputer	£5.95	....

I enclose my cheque/P.O. for ________

Cheques payable to Database Publications

Name ....

Address ....

....

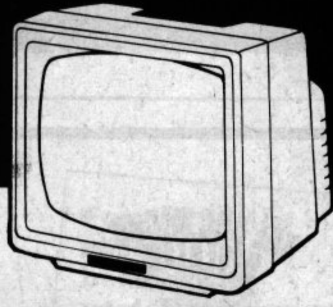
....

Post to: Database Publications,
Europa House, 68 Chester Road,
Hazel Grove, Stockport SK7 5NY.

These special prices apply to UK readers only.
Prices to overseas readers are available on request.

AT THESE PRICES YOU CAN SWITCH OVER TO A PROFESSIONAL VIDEO MONITOR

FROM ONLY £86.00



The Kaga range of monitors is designed specifically for use with micro-computers, offering flicker-free character and graphic displays. There is a Kaga monitor suitable for use with your system, be it an Apple, Commodore, BBC Acorn, Osborne, Tandy, NEC, Sharp or any other popular micro.

■ High-res. 12" B/W inc. Cable	£86
■ High-res. 12" Green inc. Cable	£96
■ High-res. 12" Amber inc. Cable	£102
■ 12" RGB Colour Monitor (med. res.)	£225
■ 12" RGB Colour Monitor (high res.)	£276
■ RGB Cable for BBC	£8

For your BBC Acorn

Phone for our latest low prices.

AIMGRAM (09277) 68211

AIMGRAM LTD 31 Roman Gardens, Kings Langley, Herts WD4 8LG Tel: Kings Langley

EXTRAS FOR THE BBC

Unique Hardware & Software

> **HARDWARE**

> **"MEDPROM-B" EPROM PROGRAMMER** – With Machine Code Software – User Port Connection – Programs 2516/2716/2532/2732 – Software Eprom Safety Features **£79.00**

> **SOFTWARE**

> **"MEDITOR-B" FREE FORMAT TEXT FILE GEN/EDITOR** – including: **"MEDMAIL-B" MAILSHOT LABEL PRINTER** – Professional Word Processor. Features enable Edit, Save, Compose and Append Text with Single Key Letter Commands **£9.50**

> **"MEDMON-B" MACHINE CODE MONITOR** – 20 Commands – Dissassemble, Memchange, Break-points, Search, Relocate, Offset, etc – Invaluable for Program Development and to reveal the Machine Operating System. **£9.95**

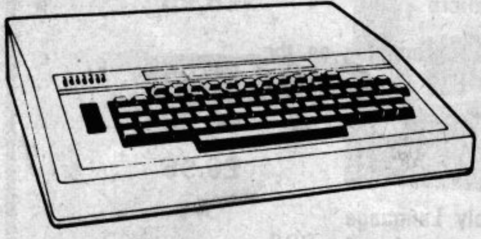
Medmon also available in Eprom, for use with all versions of O.S. **£17.00**

All prices include p&p.
Please add VAT

MED

Microtrol Engineering Design Ltd.
Dept M, 640 Melton Rd, Thurmaston,
Leicester LE4 8BB.
Tel: 0533 704492

3D COMPUTERS THE ACORN SPECIALISTS



BBC Micros Ex-stock

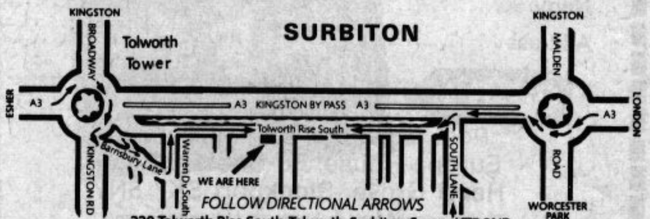
PERIPHERALS
PRINTER
COLOUR MONITOR
DISC DRIVE
TORCH Z80 DISC
CASSETTE RECORDER

SOFTWARE
ACORNSOFT
BBC SOFT
PROGRAM POWER
BUG-BYTE

ADD-ONS
JOYSTICK
LIGHT PEN
GRAPHICS TABLET
TELETEXT
Z80 PROCESSOR
6502 PROCESSOR
MEMORY UPGRADE
DISC INTERFACE

BOOKS
30 HOUR BASIC
BBC BASIC
BBC MICRO REVEALED
LET YOUR BBC TEACH
LEARNING TO USE BBC
ASSEMBLY LANGUAGE

AGENT FOR WARRANTY REPAIRS & SERVICE



SURBITON
KINGSTON
BROADWAY
Tolworth Tower
ESHER
A3
A3 KINGSTON BY PASS A3
Tolworth Rise South
Barnsbury Lane
Warren Dr South
WE ARE HERE
KINGSTON RD
EPSOM
FOLLOW DIRECTIONAL ARROWS
SOUTH LANE
KINGSTON
MALDEN
ROAD
LONDON
A3
WORCESTER PARK

230 Tolworth Rise South, Tolworth, Surbiton, Surrey KT5 9NB
Telephone: 01-337 4317 Telex: 945966 AIRCLA G

SUTTON
Belmont Station
Station Road
Brighton Road
WE ARE HERE
Avenue Road
CHEAM
Belmont Rise A217
A217
BANSTEAD

30 Station Road, Belmont, Sutton, Surrey SH2 6BS
Telephone: 01-642 2534

From Page 41

```
10REM ******************************
     *        DEATH WATCH          *
     *   Brian and Marian Clark    *
     *   BBCMU  Copyright(C) 1983  *
     ******************************
   20 PROCAS:*TV255
   30 MODE7:PROCTITLE:PROCVBL:*FX11
   40 MODE2:PROCINIT:U%=0:V%=0:G%=0:Q%=0
:PROCPLAY:MODE7:PROCDONE:GOTO40
   50 DEFPROCPLAY
   60 PROCFR:PROCFR:PROCMV:PROCFR:PROCFR
:PROCMV
   70 PROCFR:PROCFR:PROCMV:PROCFR:PROCPT
:PROCFR:PROCMV:*FX15,1
   80 IFG%=0GOTO60:ELSEENDPROC
   90 DEFPROCPT:IFG%ENDPROC
  100 IFA%=0AND RND(20)=2:A%=6
  110 IFA%=0GOTO160
  120 A%=A%-1:COLOUR13:COLOUR134
  130 PRINTTAB(A%,(A%+2))CHR$225TAB((A%+
1),(A%+3))" ":IFA%=0PRINTTAB(0,2)" "
  140 COLOUR128:IFA%=2AND RND(3)=3PROCAE
  150 PROCFR
  160 IFT%>0GOTO230
  170 IFD%<14 E2%=14
  180 IFB%=14T%=3:D%=13:L%=0:C%=2:GOTO23
0
  190 T%=RND(3):E1%=-1:E2%=17:D%=9+RND(9
):IFT%=3:D%=D%-6:L%=0:C%=2:GOTO230
  200 IFD%<16T$=T4$:T5$=T3$:T6$=CHR$232+
CHR$231:C%=3:ELSET$=T1$:T5$=T2$:T6$=CHR$
255+CHR$247:C%=1
  210 IFD%<15 E2%=E2%-(16-D%):E1%=4
  220 PROCFR:IFT%=0GOTO170
  230 COLOURC%:SOUND0,-10,6,0:ONT%GOTO24
0,290,330
  240 IFE1%>16PRINTTAB(E1%,D%)"    ";:T%=
0:ENDPROC
  250 E1%=E1%+1:PRINTTAB(E1%,D%)T$;
  260 IFE1%>6AND E1%<10PRINTTAB(E1%,D%)"
 "T6$;:IFE1%=8PROCSH
  270 IFD%<14AND D%=E1%-2L%=D%-7:PRINTTA
B(E1%,D%)"    ";:D%=E1%+1:T%=3:C%=2:GOTO3
30
  280 ENDPROC
  290 IFE2%<1PRINTTAB(0,D%)"    ";:T%=0:E
NDPROC
  300 E2%=E2%-1:PRINTTAB(E2%,D%)T5$;
  310 IFE2%<11AND E2%>7PRINTTAB(E2%,D%)T
6$" ";:IFE2%=9PROCSH
  320 ENDPROC
  330 PROCTS:ENDPROC
  340 DEFPROCFR:IFG%ENDPROC
  350 X%=?&71*256+?&70:REPEATUNTILTT%<TI
ME:TT%=TIME+4:IFBX%<>0GOTO390
  360 IFINKEY(0)<>13ENDPROC
  370 S%=40*ABS(640-X%)*1024/(Y%*1248):B
X%=X%-40:BY%=Y%:IFX%<640S%=-S%
  380 BX%=BX%+S%:BY%=BY%+32
  390 VDU5:MOVEBX%,BY%:GCOL0,0:VDU248:GC
OL0,15
  400 SOUND1,-6,(250-BY%/10),1:SOUND0,-4
,4,1:SOUND2,-6,(240-BY%/10),1
  410 BX%=BX%+S%+S%:BY%=BY%+64
  420 MOVE(BX%-10),(BY%-20):Z%=POINT((BX
%-10),(BY%-20)):IFZ%<>0GOTO460
  430 MOVE(BX%+16),(BY%+16):Z%=POINT((BX
%+16),(BY%+16)):IFZ%<>0GOTO460
  440 MOVE(BX%+16),(BY%-20):Z%=POINT((BX
%+16),(BY%-20)):IFZ%<>0GOTO460
  450 MOVEBX%,BY%:VDU248,4:ENDPROC
  460 IFZ%=14ORZ%=4ORZ%=6GOTO410:ELSEPRO
CEX
  470 ENDPROC
  480 DEFPROCSN:SOUND0,-15,7,30:FORJ%=25
0TO100STEP-5:SOUND1,0,J%,1:NEXT:ENDPROC
  490 DEFPROCGB:SOUND0,-15,7,8:FORJ%=200
TO160STEP-5:SOUND1,0,J%,1:NEXT:ENDPROC
  500 DEFPROCEX:IFZ%=7ORZ%=-1PROCGB:GOTO
520
  510 T%=0:IFRND(2)=2ORZ%=13PROCGN:ELSEP
ROCGB:U%=U%+5
  520 PROCSC:BX%=0:ENDPROC
  530 DEFPROCSC:IFQ%>99Q%=100
  540 @%=5:VDU4:COLOUR134:PRINTTAB(4,0)U
%;:@%=3:PRINTTAB(16,0)Q%:COLOUR128:ENDPR
OC
  550 DEFPROCS:Z1%=0:Z2%=4:IFZ%=2Z1%=2:Z
2%=3
  560 IFZ%=1Z1%=0:Z2%=4:ELSEIFZ%=3Z1%=1:
Z2%=3
  570 FORJ%=0TO1:FORI%=Z1%TOZ2%:MOVE(BX%
+I%*32),(BY%+12+J%*32)
  580 PRINTE$:SOUND1,0,M%,1:M%=M%-7:NEXT
:NEXT:ENDPROC
  590 DEFPROCGN:SOUND0,-15,7,30:M%=250:G
COL0,2:BX%=BX%-84:BY%=BY%-16:T1%=TIME+8
  600 E$=CHR$249:PROCS:GCOL0,9:PROCS:GCO
L0,0:IFZ%=13GCOL0,6
  610 IFZ%=13ANDBX%<640A%=0:ELSEIFZ%=13A
NDBX%>640COLOUR6:VDU4,31,B%,8,238,5:B%=2
1:COLOUR1
  620 E$=CHR$238:PROCS:GCOL0,2:U%=U%+10*
Z%:T%=0:IFU%>1500AND V%=0:PROCBN
  630 ENDPROC
  640 DEFPROCMV:IFG%ENDPROC
  650 IFINKEY(-98)=-1CALLLT:ENDPROC
  660 IFINKEY(-67)=-1CALLRT
  670 ENDPROC
  680 DEFPROCFN:PRINTTAB(5,14)"GAME OVER
"
  690 G%=GET:IFG%<>32GOTO690
  700 ENDPROC
  710 DEFPROCSH:VDU18,0,9,5:MOVE576,((32
-D%)*32):IFB%=14AND L%>3MOVE800,((24-L%)
*32)
  720 VDU253,4:PROCSI:IFBX%>0AND RND(2)=
2:VDU5:MOVEBX%,BY%:GCOL0,0:VDU248,4:GCOL
0,15:BX%=0
  730 ENDPROC
  740 DEFPROCSI:SOUND0,-15,3,15:SOUND1,3
,200,15:SOUND2,3,150,15
  750 FORJ%=0TO2:T1%=TIME+10:VDU19,0,J%,
0,0,0:REPEATUNTILTIME>T1%:NEXT
  760 Q%=Q%+RND(20):PROCSC:IFQ%>99PROCFN
  770 ENDPROC
  780 DEFPROCAS:DIM ZZ%352:FORC%=0TO2STE
P2:P%=ZZ%:[OPTC%
  790 .RT LDA&71:CMP#3:BMIR1:BEQR2:RTS
  800 .R2 LDA&70:CMP#72:BMIR1:RTS
  810 .R1 LDA&70:CLC:ADC#20:STA&70:LDA&7
1:ADC#0:STA&71:LDA#128:STA&7F:JSRM1
  820 JSRG1:LDA#20:STA&7F:JSRM2:LDA#4:ST
A&7F:JSRM3:LDA#85:STA&7F:JSRM4
  830 LDA#88:STA&7F:JSRM1:LDA#18:JSR&FFE
E:LDA#0:JSR&FFEE:LDA#0:JSR&FFEE:LDA#60
  840 STA&7F:JSRM2:LDA#4:STA&7F:JSRM3:LD
A#40:STA&7F:JSRM2:LDA#85:STA&7F:JSRM3:RT
S
  850 .LT LDA#1:CMP&71:BMIL1:BEQL2:RTS
  860 .L2 LDA#174:CMP&70:BMIL1:RTS
  870 .L1 LDA&70:SEC:SBC#20:STA&70:LDA&7
1:SBC#0:STA&71:LDA#88:STA&7F:JSRM1:JSRG1
  880 LDA#40:STA&7F:JSRM2:LDA#4:STA&7F:J
SRM3:LDA#20:STA&7F:JSRM2:LDA#85:STA&7F
  890 JSRM3:JSRG1:LDA#128:STA&7F:JSRM1
  900 LDA#18:JSR&FFEE:LDA#0:JSR&FFEE:JSR
&FFEE:LDA#4:STA&7F:JSRM4
  910 LDA&70:CLC:ADC#20:STA&80:LDA&71:AD
C#0:STA&81:LDA#85:STA&7F:JSRM3:RTS
  920 .M1 LDA#25:JSR&FFEE:LDA#4:JSR&FFEE
:LDA&7F:JSR&FFEE:LDA#2:JSR&FFEE:LDA#0:JS
R&FFEE:JSR&FFEE:RTS
  930 .G1 LDA#18:JSR&FFEE:LDA#0:JSR&FFEE
:LDA#15:JSR&FFEE:RTS
```

→

HOME STUDY COURSES

You've chosen the best micro, now choose the best courses!

30 Hour BASIC
A beginner's BASIC programming course.

Structured Programming in BASIC
A second stage BASIC programming course. Shows you how to get the best out of BBC BASIC.

Beyond BASIC on the Beeb:
6502 Assembly Language Programming.
An easy introduction to assembly language programming on the BBC Micro.

All 3 courses available now as NEC correspondence courses. Write for free leaflet/enrolment form. (30 Hour BASIC text only is available, price £5.95 post free).

NATIONAL EXTENSION COLLEGE
Dept 46, 18 Brooklands Avenue,
Cambridge CB2 2HN

Buy BRITISH! Buy the BEST!
Buy the BBC computer from

TWICKENHAM
COMPUTER CENTRE LTD
01-892 7896 • 01-891 1612

In stock now at at Twickenham's official BBC/Acorn dealer and service centre

BBC Model A £299. Model B £399. plus all the extras:

★ **Expansion** Both **Model A** and **Model B** may have the following expansion options fitted **Internally** at purchase, or by Dealers at a later date.
• Floppy disk interface
• Econet network interface (separate leaflet available)
• Voice synthesis circuits • Cartridge ROM pack interface
• Various alternative high-level languages in ROM
External options which plug directly into the machine include:
• Paddles • Cassette Recorder
• Black and White and colour monitors and televisions
• 5¼" single-sided disk drive (100K)
• 5¼" dual double-sided track density disk drives (800K)
• 80 column dot matrix printer • Daisy Wheel Printer
• Teletext acquisition unit • Prestel acquisition unit – both of these enable Telesoftware to be downloaded into the BBC Computer as well as providing access to the normal Teletext/Prestel services. Pages may be "grabbed" and stored for later use
• 3MHz 6502 second processor with 60K of RAM
• Z80 second processor with 60K of RAM and a fully CP/M-compatible operating system
The BASIC interpreter is an extremely fast implementation, very close to the Microsoft standard, but with numerous powerful extensions:
• Long variable names • Integar, floating point and string variables
• Multi-dimension integer, floating point and string arrays • Extensive support for string handling
• IF… THEN… ELSE ★ REPEAT… UNTIL
• Multi-line integer, floating point and string functions • Procedures • Local variables
• Full recursion on all functions and procedures • Effective error trapping and handling
• Cassette loading and saving of programs and data
• Full support for the extensive colour graphics facilities
• Easy control of the built-in music generation circuits
• Built-in 6502 mnemonic assembler enabling BASIC and assembler to be mixed, or pure assembly language programs to be produced.

Cartridges and tapes in stock!
COMPUTERS, PERIPHERALS, PRINTERS, SOFTWARE, GAMES, BOOKS
ALWAYS IN STOCK
Plus many more, all from leading manufacturers at low prices!
72 Heath Road Twickenham Middx TW1 4BW

The BBC Microcomputer Specialists

GUILDFORD COMPUTER CENTRE offers a complete range of Computers for Home, Business and Educational applications.

Large stock of additional equipment available includes:- Printers, Hard/Floppy Disc drives, Monitors etc., for most makes.

An extensive range of Business software (Accounts, Stock, Payroll, Word Processing etc.).

Drop in for a frank discussion and expert advice on your requirements or arrange a demonstration. We give a full and expert backup to ALL our sales.

Stockists of:- BBC/Acorn, Torch, Oric, Olivetti, Hitachi, TRS-80, Commodore, Dragon, Sharp, Sirius, Osborne, IBM, Newbrain, Epson, Seikosha, Cumana, etc.

commodore olivetti ACORN COMPUTER HITACHI BBC TRS-80®

GUILDFORD
COMPUTER
C·E·N·T·R·E
1 The Quadrant, Bridge Street,
Guildford, Surrey. GU1 4SG
Telephone (0483) 578848

Deathwatch listing

From Page 73

```
 940 .M2 LDA&70:SEC:SBC&7F:STA&80:LDA&7
1:SBC#0:STA&81:RTS
 950 .M3 LDA#25:JSR&FFEE:LDA&7F:JSR&FFE
E:LDA&80:JSR&FFEE:LDA&81:JSR&FFEE:LDA#16
0:JSR&FFEE:LDA#0:JSR&FFEE:RTS
 960 .M4 LDA#25:JSR&FFEE:LDA&7F:JSR&FFE
E:LDA&70:JSR&FFEE:LDA&71:JSR&FFEE:LDA#16
0:JSR&FFEE:LDA#0:JSR&FFEE:RTS
 970 ]:NEXT:ENDPROC
 980 DEFPROCTITLE:FORJ%=2TO3:PRINTTAB(6
,J%)CHR$129CHR$141"**** DEATH WATCH ****
":NEXT
 990 PRINTTAB(3,7)CHR$130"Your  mission
 is  to  hold"''TAB(3)CHR$130"the fort
as long as possible"''TAB(3)CHR$130"agai
nst the combined forces"
 1000 PRINTTAB(3,14)CHR$130"Controls are
 as follows:"''TAB(6)CHR$133"Z          Tu
rn barrel left"'TAB(6)CHR$133"X          T
urn barrel right"'TAB(6)CHR$133"RETURN
 to fire"'TAB(6)CHR$133"SPACE    at end
of game"
 1010 PRINTTAB(4,22)"Try for a high numb
er of hits:";:I%=GET:ENDPROC
 1020 DEFPROCAE:MOVE192,850:GCOL4,0:PLOT
21,600,166:PROCSI
 1030 IFQ%>0MOVE192,850:GCOL4,0:PLOT21,6
00,166
 1040 ENDPROC
 1050 DEFPROCBN:V%=1:VDU4:COLOUR132:COLO
UR9:CLS:PRINTTAB(5,7)"TEMPORARY":COLOUR7
 1060 PRINTTAB(5,12)"CEASE-FIRE"TAB(3,20
)"TIME TO REPAIR":COLOUR128
 1070 FORI%=180TO70STEP-10:SOUND1,-15,I%
,3:SOUND2,-15,I%,3:NEXT:FORI%=60TO150STE
P20:SOUND1,-15,I%,6:SOUND2,-15,I%,6:NEXT
 1080 Q%=Q%-33:IFQ%<0Q%=0
 1090 T1%=TIME+400:REPEATUNTILT1%<TIME:P
ROCINIT:ENDPROC
 1100 DEFPROCINIT:VDU12,23;10,32;0;0;0;1
9,2,0,0,0,0,19,1,0,0,0,0,19,3,0,0,0,0
 1110 VDU19,0,2,0,0,0,19,15,1,0,0,0,19,1
4,3,0,0,0,19,13,0,0,0,0,28,0,8,19,0
 1120 COLOUR134:VDU12,26:COLOUR128:VDU19
,8,7,0,0,0:COLOUR136:COLOUR1
 1130 FORI%=1TO8STEP2:PRINTTAB(I%,30)CHR
$226;:NEXT:FORI%=12TO19STEP2
 1140 PRINTTAB(I%,30)CHR$226:NEXT:PRINTS
TRING$(20,CHR$226);:VDU30,8:COLOUR128:PR
INTTAB(9,31)SPC2;
 1150 VDU19,7,6,0,0,0:VDU28,0,4,19,0:COL
OUR135:CLS:VDU26:COLOUR1:PRINTTAB(0,0)"H
ITS    0 DAMAGE  0%":COLOUR128
 1160 FORI%=0TO5+RND(10):X%=RND(5)-1:Y%=
7+RND(4):IFY%=8COLOUR134:ELSECOLOUR128
 1170 COLOUR4:PRINTTAB(X%,Y%)CHR$224:NEX
T
 1180 X1%=600:X%=640:Y%=160:Y1%=Y%:E1%=0
:E2%=17:T%=0:BX%=0:L%=0:B%=20:A%=0:TT%=T
IME+20:?&70=128:?&71=2
 1190 GCOL0,14:MOVE1280,550:MOVE 1280,60
0:PLOT85,900,732:GCOL0,4:PLOT85,1280,732
:GCOL0,15:MOVE600,0:MOVE600,Y%:PLOT85,64
0,0:PLOT85,640,Y%
 1200 COLOUR128:COLOUR1:ENDPROC
 1210 DEFPROCVBL:ENVELOPE3,2,-1,0,0,50,0
,0,120,-1,0,-1,60,80:*FX4,1
 1220 VDU23,253,0,0,1,1,0,0,0,0,23,252,&
FF,&FF,&FF,&FF,&FF,&FF,&FF,&FF
 1230 VDU23,255,3,&1F,&1F,&1F,&FF,&FF,&F
F,&AA,23,254,&C0,&FF,&FF,&E0,&FE,&FF,&FF
,&AA:T1$=" "+CHR$255+CHR$254
 1240 VDU23,225,&FE,&10,&29,&45,&FF,&FE,
&7C,&38,23,226,0,4,4,4,4,&7E,4,0
 1250 VDU23,230,0,0,1,&3F,&F,&F,0,0,23,2
31,0,0,&80,&F0,&F0,&F0,0,0:T3$=CHR$230+C
HR$231+" "
 1260 VDU23,232,0,0,1,&F,&F,&F,0,0,23,23
3,0,0,&80,&FC,&F0,&F0,0,0:T4$=" "+CHR$23
2+CHR$233
 1270 VDU23,249,&55,&AA,&99,&81,&18,&99,
&AA,&55
 1280 VDU23,248,0,&18,&3C,&3C,&3C,&3C,&1
8,0,23,238,&FF,&FF,&FF,&FF,&FF,&FF,&FF,&
FF
 1290 VDU23,251,0,1,1,7,&FF,&7F,&3F,&1F,
23,250,0,0,&10,&FC,&FF,&FF,&FF,&FF:B$=CH
R$251+CHR$250+" "
 1300 VDU23,247,&C0,&F8,&F8,&F8,&FF,&FF,
&FF,&55,23,246,3,&FF,&FF,&07,&7F,&FF,&FF
,&55:T2$=CHR$246+CHR$247+" "
 1310 VDU23,245,0,0,&24,&3C,&3C,&3C,&24,
0,23,244,0,0,0,0,0,&18,&3C,&3C,23,243,&2
4,&3C,&3C,&3C,&3C,&3C,&34,&10,23,242,&42
,&7E,&7E,&7E,&7E,&7E,&7E,&7E,23,241,&7E,
&7E,&52,&52,&10,&10,0,0
 1320 VDU23,224,&18,&24,&42,&42,&19,&52,
&99,&18
 1330 VDU23,240,&81,&FF,&FF,&FF,&FF,&FF,
&FF,&FF,&FF,23,239,&FF,&FF,&FF,&FF,&91,&
91,&10,&10
 1340 DIM TT(10),TT$(10):FORI%=1TO10:TT(
I%)=0:TT$(I%)=" ":NEXT:ENDPROC
 1350 DEFPROCTS:L%=L%+1:ON L% GOTO1360,1
380,1390,1400,1410,1420,1430,1450,1460,1
480,1490,1500,1510
 1360 COLOUR134:IFB%>14 B%=B%-1:IFB%<20C
OLOUR13:PRINTTAB(B%,8)LEFT$(B$,(20-B%)):
IFB%=14D%=13
 1370 PRINTTAB(D%,8)CHR$244:COLOUR128:CO
LOUR2:ENDPROC
 1380 COLOUR134:PRINTTAB(D%,8)" ":COLOUR
128:PRINTTAB(D%,9)CHR$244:ENDPROC
 1390 PRINTTAB(D%,9)" "TAB(D%,10)CHR$245
:ENDPROC
 1400 PRINTTAB(D%,10)" "TAB(D%,11)CHR$24
3:ENDPROC
 1410 PRINTTAB(D%,11)" "TAB(D%,12)CHR$24
3:ENDPROC
 1420 PRINTTAB(D%,12)" "TAB(D%,13)CHR$24
3:ENDPROC
 1430 PRINTTAB(D%,13)" "TAB(D%,14)CHR$24
2TAB(D%,15)CHR$241:IFB%=14PROCSH
 1440 ENDPROC
 1450 PRINTTAB(D%,14)" "TAB(D%,15)CHR$24
2TAB(D%,16)CHR$241:ENDPROC
 1460 PRINTTAB(D%,15)" "TAB(D%,16)CHR$24
2TAB(D%,17)CHR$241:IFB%=14PROCSH
 1470 ENDPROC
 1480 PRINTTAB(D%,16)" "TAB(D%,17)CHR$24
2TAB(D%,18)CHR$241:ENDPROC
 1490 PRINTTAB(D%,17)" "TAB(D%,18)CHR$24
0TAB(D%,19)CHR$239:ENDPROC
 1500 PRINTTAB(D%,18)" "TAB(D%,19)CHR$24
0TAB(D%,20)CHR$239:ENDPROC
 1510 PRINTTAB(D%,19)" "TAB(D%,20)" "TAB
(D%,21)CHR$239:T%=RND(2):L%=0:IFT%=1:E1%
=D%-2:T$=T1$:ELSEE2%=D%-1:T5$=T2$
 1520 D%=21:C%=1:T6$=CHR$255+CHR$247:T$=
T1$:ENDPROC
 1530 DEFPROCDONE:J%=0:PRINTTAB(7,3)CHR$
131"****SCORE BOARD****"TAB(9,7)CHR$130"
Enter your name:";:INPUTI$:T$=LEFT$(I$,1
6)
 1540 FORI%=10TO1STEP-1:IFU%>TT(I%):J%=I
%:I%=1
 1550 NEXT:IFJ%>0 FORI%=2TOJ%:TT(I%-1)=T
T(I%):TT$(I%-1)=TT$(I%):NEXT:TT(J%)=U%:T
T$(J%)=T$
 1560 @%=7:PRINTTAB(4,7)CHR$131"Place
  Score   Name"SPC40':FORI%=10TO1STEP-1:
IFI%=10PRINTCHR$136;:ELSEPRINT" ";
 1570 J%=139-I%:IFI%<4J%=128
 1580 PRINTCHR$(J%)11-I%"    " TT(I%)"
 "TT$(I%):NEXT
 1590 PRINTTAB(4,22)"Ready to try again?
";:I$=GET$:Q%=C%:ENDPROC
```

SPECIAL OFFER!
Deduct £1 per cassette when ordering 2 or more.

QUALITY SOFTWARE FOR THE BBC MICRO

GALAXIANS (32K) £6.50 (on cassette) £9.90 (on disc)
Fast action version of the popular arcade game. 4 types of Galaxian (in 3 initial screen formations) swoop down individually or in groups of two or three. 6 skill levels, hi-score, rankings, bonus laser bases, increasing difficulty, superb graphics and sound.

CENTIPEDE (32K) £6.50 (on cassette) £9.90 (on disc)
Incredible arcade type game featuring mushrooms, flies, snails, spiders, and the centipedes of course. Excellent graphics and sound. 6 skill levels, hi-score, rankings, bonuses, and increasing difficulty as the spiders become more active and the mushrooms increase.

FRUIT MACHINE (32K) £6.50 (on cassette) £9.90 (on disc)
Probably the best fruit machine implementation on the market. This program has it all ... HOLD, NUDGE, GAMBLE, moving reels, realistic fruits and sound effects, multiple winning lines. This is THE fruit machine program to buy.

ALIEN DROPOUT (32K) £6.50 (on cassette) £9.90 (on disc)
Based upon the arcade game of ZYGON, but our version improves upon the original arcade game itself. You have to shoot the aliens out of their "boxes" before the "boxes" fill up. Once full, the aliens fly down relentlessly, exploding as they it the ground. Suitable for use with keyboard or joystick.

INVADERS (32K) £6.50 (on cassette) £9.90 (on disc)
Superior version of the old classic arcade game including a few extras. 48 marching invaders drop bombs that erode your defences, and 2 types of spaceship fly over releasing large bombs that penetrate through your defences. Hi-score, increasing difficulty, superb sound effects and graphics.

SPACE FIGHTER (32K) £6.50 (on cassette) £9.90 (on disc)
Arcade-style game based upon features from DEFENDER and SCRAMBLE. 5 types of menacing alien fire at you and may attempt to ram you. Separate attack phases, fuel dumps, asteroids, repeating laser cannon, smark bombs, hi-score, rankings, 6 skill levels, bonsues.

WE PAY 25% ROYALTIES FOR HIGH QUALITY PROGRAMS
Please add 50p per order p.p. + 15% VAT

SUPERIOR SOFTWARE
Dept. BMI 69 Leeds Road
Bramhope, Leeds.
Tel: 0532 842714

DISC SOFTWARE AVAILABLE NOW!

Some DRAGON versions available

H&H SOFTWARE

Software for the BBC Computer

Model B only

ALPHABETA A complete Word Processing Package with instantaneous response. Features include automatic wrapround, insert, delete, over-write, title centring, tabs, merging and other editing facilities. Up to 224 lines of 80 characters can be produced. For longer documents editing between files is possible. Price includes a manual and labels for the red keys..............£28.50

BILLIARDS This is a game of skill and cunning. Key in the direction, pace and backspin on your cue ball and watch the result. The computer does the rest.................................£8.50

TESS Are you bursting with imagination or flare for graphic designing or just wanting a completely different type of program? TESS is for you. Design a shape, choose colours, pattern and size, then watch the screen fill with copies of your design interlocking together. Animations are possible, the tape includes an example..£8.50

Model A or B (Family games with sound and colour)

SHAPE and **RACE** For 6 year olds upwards. In SHAPE, a tracer bounces inside a blue box and rebounds off a hidden shape. Can you identify the shape before your opponent. The RACE is between a hare and a tortoise. First one to the flowers wins............£5.50

SIGNALS and **MAGIC** Make up sums to reveal a hidden shape. Guess the shape to get bonus points. Complete a magic square to get promoted and hear the fanfare. The higher your rank, the better the fanfare. 3 levels of difficulty..........................£5.50

Prices include cased cassette, instructions, postage etc.
Please send orders and cheques/PO/Transcash (No. 614 131 707) to:

H&H, Dept T, 53 HOLLOWAY, RUNCORN, CHESHIRE.

For further information please send S.A.E.

CABEL electronic MONITOR MANUFACTURER

BUY BRITISH

NEXT MONTH £?

DEALER ENQUIRIES AND EDUCATON ENQUIRIES WELCOME

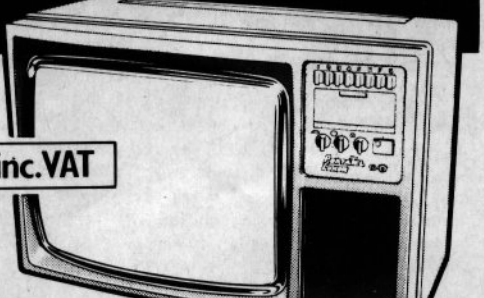
Cheque/Postal Order, or for fast delivery, ring us with your credit card number.

CABEL electronic

Mount Road, Burntwood, Walsall.
Tel: 021-308 7075
Telex: 339671 ALD FAB.

Factory:
Unit 15, Whitegate Industrial Estate,
Whitegate Road, Wrexham LL11 1AY.
Office:
Lloyds Bank Chambers, The High Street,
Tewkesbury, Gloucestershire.

TIMESHARE YOUR COLOUR MONITOR WITH THE FAMILY

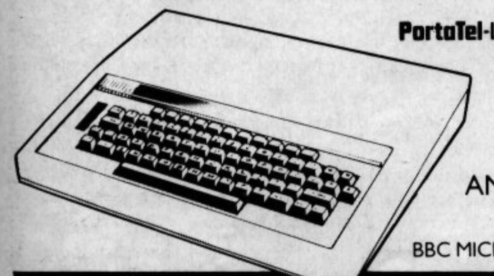


£299 inc.VAT

COLOUR TV

PLUS RGB MONITOR PLUS PAL VIDEO AND AUDIO

PortaTel-LUXOR RGB 3711



EXCELLENT
RESOLUTION
AND GEOMETRY

BBC MICRO LEAD INCLUDED

PORTATEL CONVERSIONS LIMITED,
25 SUNBURY CROSS CENTRE,
SUNBURY-ON-THAMES,
MIDDLESEX TW16 7BB
Telephone: Sunbury-on-Thames 88972

TWO WAYS TO ENSURE YOU GET BBC MICRO USER EVERY MONTH

1. Complete and mail subscription form on Page 69
2. Hand this form to your newsagent.

Please reserve me a copy of **BBC Micro User** magazine every month until further notice.

☐ I will collect

☐ I would like it delivered to my home.

Name ____________________

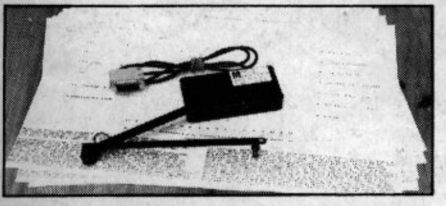
Address ____________________

____

____

Note to newsagent: BBC Micro User should be obtainable from your local wholesaler, or contact the distributor – Wells, Gardner, Darton & Co Ltd Tel: Faygate 444

A BBC MICRO GRAPHICS DIGITIZER FOR £19.95 + VAT

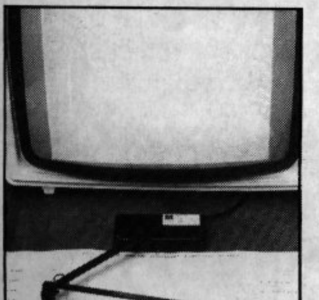


★ This a complete, assembled, tested, graphics digitizer arm for the BBC MICRO. It turns your computer into a "computerised drawing board".

NEW PRODUCTS

And a new range of cheaper, better, real-world Control Interfaces from **£19.80** + VAT

Plug a Minor Miracles Interface into your BBC Micro, and control machinery, lab experiments, central heating – anything!!



★ It can transfer designs to the screen, allow you to change graphics colours, delete part or all of the work, automatically draw verticals, horizontals or a work grid, recall from memory deleted work and much more – all selected by the arm sensor from our special supplied layout sheets.

★ For **£19.95** + VAT you will buy:

1) The Minor Miracles digitizer, tested and ready to plug in and use.

2) Five work-sheets each with full option menu and instructions.

3) The superb software in cassette.

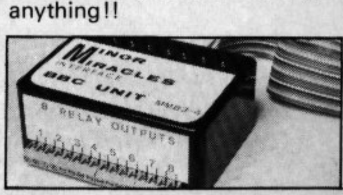
4) Delivery to your door in the UK.

★ Performance is surprisingly good, and whilst not to top professional standards is amazing at this price.

Send SAE for product and educational discount details.

MINOR MIRACLES

114 London Road, Ipswich,
Suffolk IP1 2HG.
Tel: 0473 50080 10am - 5pm



Each unit automatically isolates the computer from external voltages.

MM 83/1 High speed solid state, four inputs, four outputs, each can sink 48 VDC ½ amp **£19.95**

MM 83/2 HIGH VOLTAGE four-in, four-out, 240 VAC 1 amp or 24 VDC 2 amp **£22.95**

MM 83/3 EIGHT high-speed output channels, each up to 48 VDC ¼ amp ... **£19.80**

MM 83/4 High voltage version of above **£24.60**

MM 83/5 EIGHT isolated input channels **£19.95**

All are ready to use, with instructions and software listings.
Add 15% VAT + £1 P&P.

BBC B main board CIRCUIT DIAGRAMS with Econet etc.
£2.50 plus large SAE inclusive return-of-post.

EDUCATIONAL PROGRAMS
for BBC Model B (32K)
Suitable for 9-16 year olds

GEOGRAPHY – ITALY – colour graphics, mountains, rivers, cities etc. tests **£5**
GEOGRAPHY – FRANCE – colour graphics mountains, rivers, cities etc. tests **£5**
MATHS – TRANSLATIONS – colour diagrams, explanations, calculations etc. tests **£5**
for – class instruction by teacher – OR individual learning.

CORONA (SOFTWARE)
21 Tennyson Avenue, London E11 2QN.
Telephone: 01-989 8534

Micro-Aid (BN),
25 Fore Street, Praze, Camborne, Cornwall TR14 0JX. Tel: 0209 831274

2 **Cashbook B**	Double entry Cashbook with accounts.	£ 4.95	B
4 **Mailing B**	Database mailing system with 6 options including 2 sorts, labels, search and updating.	£ 4.95	B
5 **Payroll**	Two part program to handle weekly or monthly wages for around 100 employees. Fully supported.	£11.90	B
101 **Cards**	Beat Bruce Forsyth at his own game.	£ 2.95	A/B
102 **Battle**	Fast moving simulation of Falklands minefield.	£ 2.95	B
501 **Banner**	Print out large text and graphic characters.	£ 2.95	A/B
502 **Distances**	Graphic maps of U.K., EUROPE and WORLD. Calculates distances between any two points on Earth.	£ 2.95	B
503 **Flags**	Full colour flags of the world. Educational.	£ 2.95	B
504 **Statpack**	Statistics offering over 18 options.	£ 7.95	B
505 **Memo-calc**	A database spreadsheet	£ 7.95	
	(manual extra)	£ 2.00	
801 **Searchbas**	PROC to search a BASIC program and alter it.	£ 1.95	A/B
802 **Procvar**	PROC to list all variables used in a program.	£ 1.95	A/B
803 **Procflush**	PROC to clean out memory including integers.	£ 1.00	A/B
804 **Procaid**	A combination of 801, 802 and 803.	£ 2.95	A/B
805 **Defchr**	Design graphic characters, display and store.	£ 2.95	A/B
806 **Sortm/c**	Machine Code Bubble sort for up to 255 integers.	£ 1.00	A/B
807 **Softbas**	A very fast BASIC sort. 1000 items in 42 secs.	£ 1.00	A/B
808 **Utility A**	A combination of 801-807. Super value.	£ 4.95	A/B

Easter at Falmouth in Cornwall for a computer jamboree. Caravans for up to 6 people at a per caravan price of July and August prices £110 and £120 per week. **£30.00** per week

Jessop
microelectronics

Manufacture and supply
The Edinburgh Turtle
The Visispeech Display System
Computer applications in special education

We are official BBC-Acorn dealers.

For lists, prices, demonstrations please contact:
Jessop Microelectronics Ltd., Unit 5, 7 Long Street, London E2 8HN.
Tel: 061-739 3232/729-1851

FAIRHURST INSTRUMENTS LTD

BBC

SERVICE & INFORMATION CENTRE
Dean Court, Wilmslow SK9 2LT.
Telephone: (0625) 525694

Advertisers Index

A&F Software I/F/C
Aimgram 72

Cabel 76
Computer Concepts 23
Clare 42
Corona Software 78
Computer City I/B/C
Cumana Insert

D.A. Computers 68
Data Efficiency Ltd 8
D.R.G. 17
Digital Fantasia 31

Fairhurst Instruments 78

Gemini Marketing 6, 7
Gaelsett Software 68
Guildford Computer Centre 74

Simon Hessell 37
H. & H. Software 76

I.J.K. Software 13
Ikon 42

Jessop Micro Electronics 78

Kansas City Systems 35

Microaid 78
Micropower O/B/C
Micromanagement 57
Microvitec 3
Midwich Computer Co. 29
Minor Miracles 77
M.E.D. Ltd 72

National Extension College 74

Opus Supplies 45

Pace 44
Portatel Conversions 77

RMK Electronics 78

Silicon Expires 3
Software 59
Superior Software 76

3D Computers 72
Twickenham Computer Centre 74

Video Palace 42

Watford Electronics 18

RMK
Electronics Ltd

BBC

ACORN COMPUTER

Southampton
Portsmouth
New Milton
Bournemouth

DISC DRIVES
Shugart 40 Track S.S. 100K – **£185** cased inc. VAT, cables, etc.

BUSINESS SOFTWARE
Sales Ledger – Nominal Ledger

RAPID REPAIR SERVICE
Disc and A/B Upgrades
One hour service – phone for appointment.

RMK ELECTRONICS LTD
First Floor, Hinton House, Station Road,
New Milton, Hants. BH25 6HZ.
Tel: 0425 616110

COMPUTER CITY

78 VICTORIA ROAD, WIDNES, CHESHIRE

051-420 3333

The Computer Centre of the North

BBC microcomputer systems in Education, Business and Leisure

Authorised Dealers for BBC Micro.

BBC Micro Model A	£299.00
BBC Micro Model B	£399.00
BBC Model A Micro with 32K	£338.30
BBC Model A Micro 32K & VIA	£345.00
Disc Upgrade for BBC B	£92.00
14″ Colour Monitor for BBC	£287.50
BMC 14″ Colour Monitor	£258.75
BMC12A 12″ Black/Green Monitor	£90.85
Cassette Recorder for BBC	£29.90

Single 5.25″ Disc Drive 100K	£265.00
Single 5.25″ Disc Drive 200K	£328.90
5.25″ Discs for BBC 40/80 tracks	£2.20
Epson MX80T type 3 for BBC	£373.75
Epson MN80F/T type 3 for BBC	£396.75
Cassette lead for BBC	£4.60
Printer lead for BBC	£17.25
Seikosha GP100 A Printer	£229.94
Seikosha GP250X	£274.85
Listing Paper	£19.55

Call in and buy or mail order for the biggest and best selection of BBC Software in the WORLD!!

ACORNSOFT	
Business Games	£9.95
Tree of Knowledge	£9.95
Peeko-Computer/Manual	£9.95
Algebrail Manipulation Pack	£9.95
Creative Graphics	£9.95
Graphs & Charts	£9.95
Desk Diary/Manual	£9.95
Lisp Cassette	16.85
Forth Cassette	£16.85
Philosophers Quest	£9.95
Spinx Adventure	£9.95
Monsters	£9.95
Snapper	£9.95
Planetoid	£9.95
Arcade Action	£11.90
Rocket Raid	£9.95
Meteors	£9.95
Arcadians	£9.95
Sliding Block Puzzles	£9.95
Cube Master	£9.95
Chess	£9.95
Super Invaders	£9.95

BUG BYTE	
Space Pirates (16K)	£8.00
Space Warp (32K)	£9.00
Golf (32K)	£5.50
BBC Dragon Quest	£11.50
BBC Fruit Machine	£5.50
BBC Airlift	£5.50
Polaris (32K)	£5.50
BBC Chess (32K)	£8.00
BBC Backgammon (16K)	£8.00
BBC Multifile (16K)	£15.00

Lots of BBC Micro Books

WRITTEN ANY PROGRAMS? WE PAY 20% ROYALTIES ON BBC PROGRAMS

I.J.K.	
Star Trek	£6.50
Hangman	£4.50
Mutant Invaders	£6.50
Beep Beeb	£4.50
Beebmunch	£6.50
Super Hangman	£4.50
3D Maze	£4.50
Model A Invaders	£5.50
Model B Invaders	£7.50
Word Pro	£10.50
Atlantis	£7.50
Flags	£4.50
Hyperdrive	£6.50
Stato Bomber	£7.50

A. & F.	
Lunar Lander	£6.95
Planes	£8.00
Tower of Aros	£6.95
Frogger	£8.00
Pharoahs Tomb	£8.00
Painter	£8.00

SPECIAL OFFER

Deduct £1 per cassette when ordering two or more.

MICRO POWER SPACE GAMES Model B	
Swoop	£6.95
Alien Destroyers	£6.95
Galactic Commander	£6.95
Time Trek	£6.95
Laser Command	£6.95
Space Maze	£5.95
Martians	£5.95
Astro Navigator	£4.95
Maze Invaders	£4.95
Chess B	£6.95
Chess A	£4.95
Footer	£6.95
Adventure	£6.95
Cow Boy Shoot Out B	£5.95
Munching Man	£5.95
Seek A	£5.95
Eldorado Gold	£5.95
Roulette	£4.95
Reversi A&B	£4.95
Cat & Mouse	£4.95

Trade enquiries welcome

Please send me ....

I enclose cheque/P.O. for

OR Please debit my Access ....

BARCLAYCARD ....Expiry date....................

Send s.a.e. for Free Catalogue.

Name ....

Address ....

.... Code ....

Dealers Discount Available
ACCESS, BARCLAYCARD VISA ORDERS WELCOME ON 24HR
051-420 3333

COMPUTER CITY Dept. Q.
78 VICTORIA ROAD, WIDNES, CHESHIRE.

B.3

PROGRAMPOWERMICROPOWER

GREAT BBC PROGRAMS FROM BRITAIN'S LEADING SOFTWARE HOUSE

SWOOP

000560 HI: 001020

SWOOP

6180 Hi:67898

ALIEN DESTROYERS

2 21.6
a b c d e f g h
6
Your
Move
h1-g3

CHESS

SWOOP (B) £6.95—the NEW GALAXIANS IT'S HERE AT LAST!! Galaxian-style, machine code arcade game. THIRTY screaming, homing, bomb-dropping, explosive egg-laying BIRDMEN, swooping down in ones and two's to destroy your laser bases. The exploding eggs feature makes a normally difficult game into a challenge 'par excellence.' Each new screen means increased difficulty. Bonus bases, score display, high-score and rankings are, of course included.
YOUR WAITING IS OVER!!

ALIEN DESTROYERS (B) £6.95
Sensational, high speed 'INVADERS' program with an abundance of features. Brilliant use of sound and graphics. 48 strong Alien Fleet of three different types plus Mothership scoring mystery bonus. Choice of six alien speeds and three bomb speeds. Vertical, angled and exploding missiles. Options to replace defences and suppress new fleet advances. Bonus bases awarded each new sheet. Scoring according to overall difficulty level. Ongoing display of score and hi-score. End of game rankings of top five scores.

This program has many unique extras e.g. 'battle analysis' showing the number of each alien type shot down, how many motherships destroyed, the number of sheets cleared, the shots fired, the percentage of hits made and the number of bases lost.

CHESS (B) £6.95
Our excellent machine code program—now with superb MODE 1, colour graphics. Six skill levels, play black or white, illegal moves rejected, 'en passant', castling, take-back of moves, and display of player's cumulative move-time. Options include Blitz Chess where you must move in 10 seconds, set-up of positions for analysis, replay of a game just played and saving of part completed games on tape. On loading, a 1972 Spassky/Fischer game can be replayed.
NOTE: Model A Version still available at only £4.95.
If you wish to upgrade your Model A version please return your tape, together with £2.50 plus V.A.T.
(Special Offer does not apply for Model A upgrade)

Other B.B.C. programs available:
Galactic Commander (B) £6.95/ Laser Command (B) £6.95/ Adventure £6.95/ Cowboy Shoot-Out (B) £5.95/ Filer £8.95/Micro Budget £6.95/ World Geography (B) £5.95.
Timetrek (B) £6.95/Spacemaze (B) £5.95/Martians (B) £5.95/Astro Navigator (B) £4.95/Star Trek £4.95/Maze Invaders (B) £4.95/Footer (B) £6.95/Munchyman £5.95/Seek £5.95/Eldorado Gold (B) £5.95/Cat & Mouse £4.95/ Mastermind £3.95/Reversi 1 £4.95/Reversi 2 (B) £4.95/ Roulette (B) £4.95/Gomoku £3.95/Zombies £3.95/ Dissassembler £5.95/Constellation (B) £5.95/ Where? (B) £5.95/Junior Maths Pack (B) £5.95.

WE Guarantee THAT ALL OUR ADVERTISED PROGRAMS HAVE BEEN COMPLETED AND ARE READILY AVAILABLE

WRITTEN ANY PROGRAMS! WE PAY 20% ROYALTIES FOR DRAGON, SPECTRUM BBC, ATOM PROGRAMS

WE ARE AUTHORISED DEALERS FOR ACORN ATOM, BBC MICRO & DRAGON 32

SPECIAL OFFER
Deduct £1 per cassette when ordering two or more.

MICRO POWER LTD.
Dept. BMU3
8/8a REGENT STREET,
CHAPEL ALLERTON,
LEEDS LS7 4PE.
Tel: (0532) 683186

Please add 55p order P & P + VAT at 15%

Please Note:
All programs are now available at all good dealers or direct from MICRO POWER LTD.

PROGRAMPOWERMICROPOWER